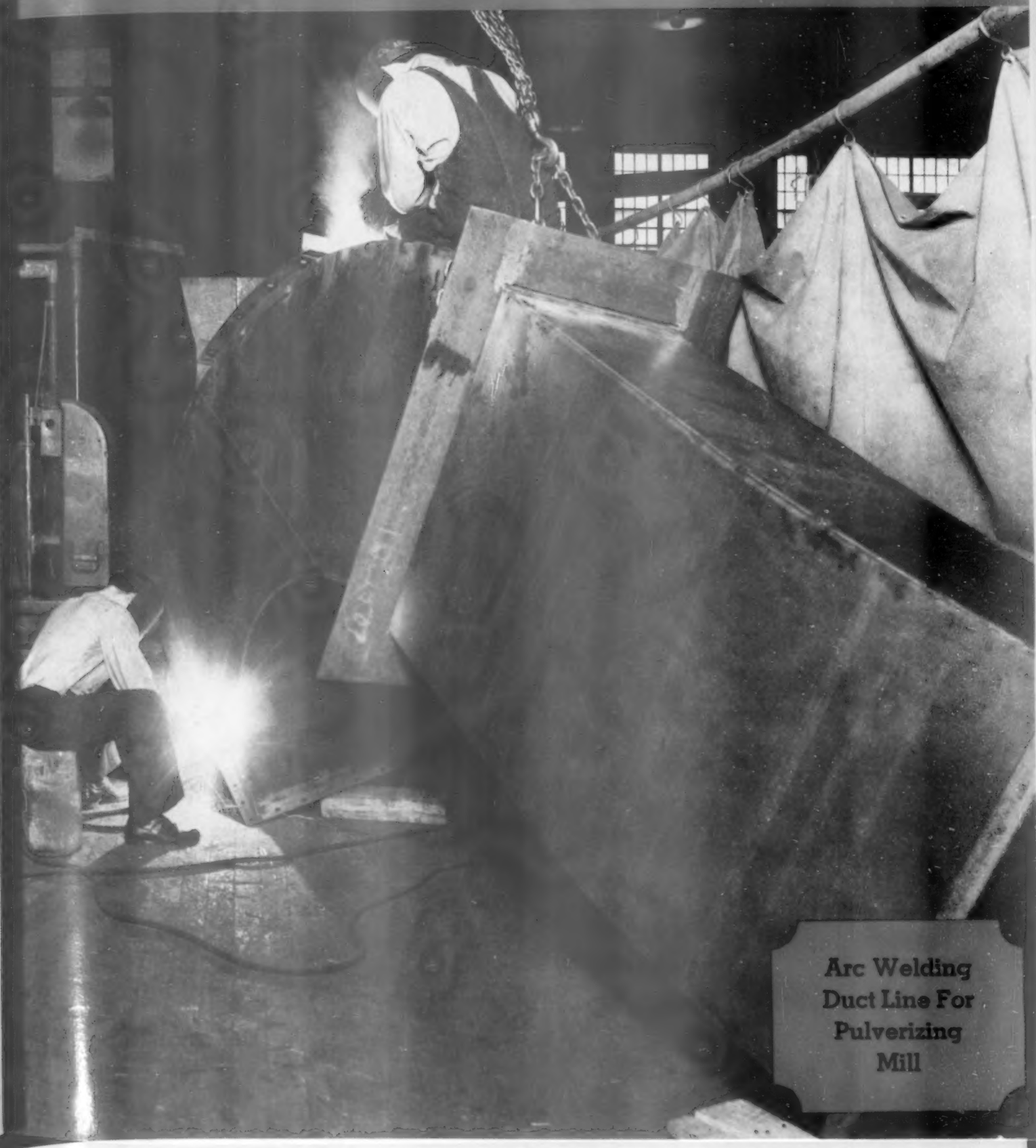
The Welding Engineer

NEER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY

lume XXIV June, 1939 JUN 26 1939 Number 6



Arc Welding Duct Line For Pulverizing Mill

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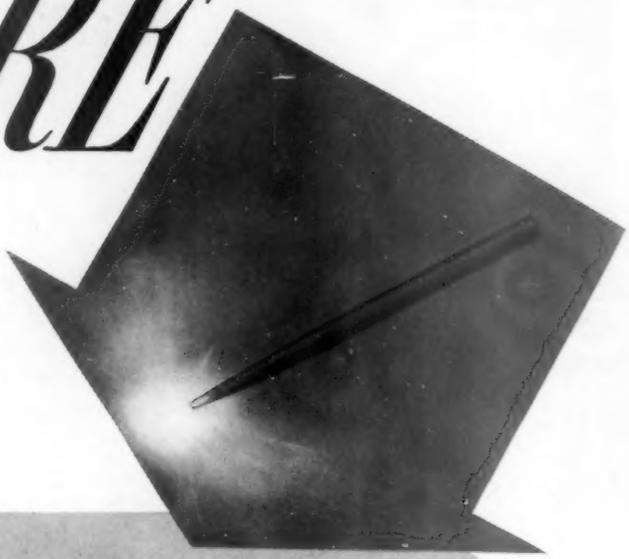

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NO. 6

The Welding Engineer

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» «

Published on the 15th of each month by The Welding Engineer Publishing Company, 506 South Wabash Ave., Chicago, Ill.
Telephone Webster 7134.

Advertising copy must be received not later than the 5th of each month.

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Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

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Join the Booster's Club

WELDING CONTRIBUTES to the general well being of society because its benefits are so widespread. Reductions in cost and improvements in product affect everyone, yet not enough people really appreciate the social significance of welding. One of the most enthusiastic boosters of welding we know of is A. F. Davis, better known as "Charlie" Davis to his friends. Just recently we were reading something he had written on this subject of boosting welding. We feel that our readers will be in full agreement with him.

"A great deal of good can result by talking about the social significance of welding," says Mr. Davis. "Not very many people know just how important a part this metal working process plays in their every day working life." There are many engineers who are not familiar with welding processes and unfortunately there are still many welding skeptics. We need to spread the gospel of welding among these important men who are in position to influence the use of welding. We need, in other words, more boosters who will tell their friends about welding, their business associates, and in fact, everyone they come in contact with.

Welded pressure vessels in the oil refining industry have made it possible to cut the cost of gasoline an average of 5 cents per gallon. Thus welding not only helps the automobile owner, but conserves our oil resources by doubling gasoline output per barrel of crude oil. It is estimated that only 15 to 20 per cent of the possible welding applications have been utilized up to the present time. We agree with Mr. Davis' conclusion: "Obviously there is a great future for men in this field. Your advancement depends not only upon your own ability and experience, but upon the demand for welders, production supervisors, engineers and others. You can help insure your advancement by helping to increase the demand for welding. Let's tell everybody about the benefits of welding to speed up the expansion and opportunities of this industry!" Yes, the more horns we toot the more jobs we will create and the better off we will be.

Welded Steel Buildings

WHEN WE REVIEWED the article on welded steel buildings prepared by Van Rensselaer P. Saxe, consulting civil engineer, we were tempted to tone it down considerably because of the author's claims for economy of the welding process. We realized that many structural engineers do not subscribe to the idea that welded buildings are cheaper. We know that this is a highly controversial subject at the present time. Hence, it was with some trepidation that we sent Mr. Saxe's story to the printer. Since the publication of the first section of his article in the May, 1939, issue, we have received no adverse comments, but we are "knocking on wood."

Mr. Saxe merely hints at the idea that established steel fabricators better watch out. They will likely have more competition in the future. The fabricator who continues to resist the application of welding will have to face the competition of the welding contractor who has a good credit rating and can buy steel about as cheaply as many fabricators. Quoting from the author, "I have in mind a fabricator in our district who a few years ago did nothing but welded tank and similar work and who today has a thriving structural business, because he took advantage of his knowledge of welding and applied it to structural work."

Mr. Saxe presents clearly and concisely four outstanding advantages of welded steel buildings:

(1) "It is an easy process of steel assembly requiring small capital outlay in machinery to produce a completed structure from plain mill shapes.

(2) "It produces a more economical structure, both in tonnage of steel required and in man-hours, to fabricate and erect.

(3) "It allows designs that produce economies which could not be undertaken by any other method of structural assembly. It is a silent fabrication and erection process, which is beneficial in the fabricating shop and of great benefit to neighborhoods in which welded structures are erected.

(4) "It does produce simpler connections than are required in riveted work and in many cases it is possible to produce structural designs which can be left exposed to view so that the steel blends in with the general architecture."

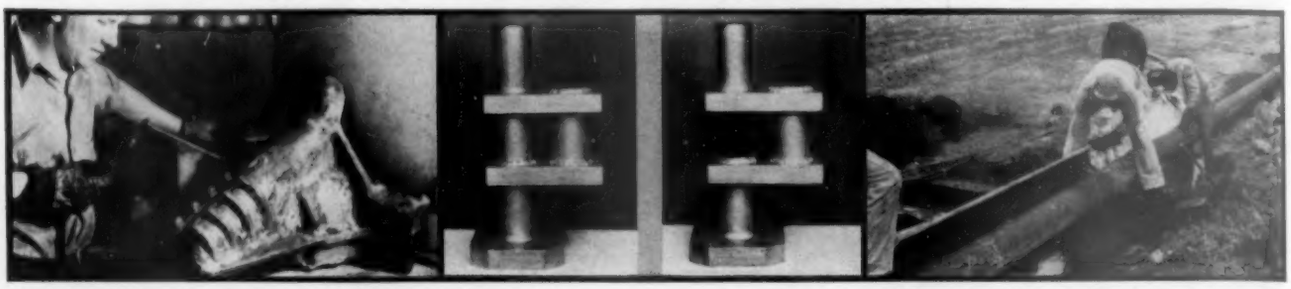
The lack of standard shop details to assist the structural engineer and draftsman is really serious. The engineer is handicapped in designing welded connections because of this deficiency. The steel companies certainly have enough at stake in this instance to cause them to cooperate with technical societies in preparation of standard welding details, equally as useful to the designer as the information pertaining to riveted connections now contained in the steel handbooks. Here is a real opportunity for some one who is interested in cutting the cost of welded designs.

HOW WOULD YOU WELD IT?

1. These bone-cutter knives, costing $30 per set of 16, are reclaimed by Lincoln Welding . . made better than new . . for $8, saving $22. What is the procedure?

2. Welded piping can be insulated in half the time required for coupled pipe. Insulation slips right over the joint. No cementing—no patching. Get the complete story of *"Shield-Arc"* welded piping.

3. Where corrosion occurs—such as in this smelter flow nozzle—there are many cost-saving approaches with Lincoln Welding. Here, a mild steel section is being replaced with wrought iron.



4. Suspended in a bath of die cast metal, cast iron pots as shown often break. Replacement cost is $65. It is repaired with Lincoln equipment for $15. How would you weld it?

5. A broken crankshaft of a deep-well pump was beyond repair, causing an emergency at a County Home. Five pieces of steel were welded to produce a new shaft. Two steps are shown.

6. Hundreds of miles of pipe lines such as this Texas oil line are reconditioned annually by Lincoln welding without interrupting service. How would you do it?

7. These coal pulverizer shafts, typical of many power plant parts that become worn, were reclaimed by Lincoln Welding at a saving of $45 each. What is the procedure?

8. Before and after welding a worn pump impeller. Metal was added with a new Lincoln Electrode for cast iron. What is this electrode and the welding procedure?

9. You can get any TYPE of arc and any AMPERAGE with the new *"Shield-Arc."* How would you set it for a large electrode job? It tells you right on the "Job Selector."

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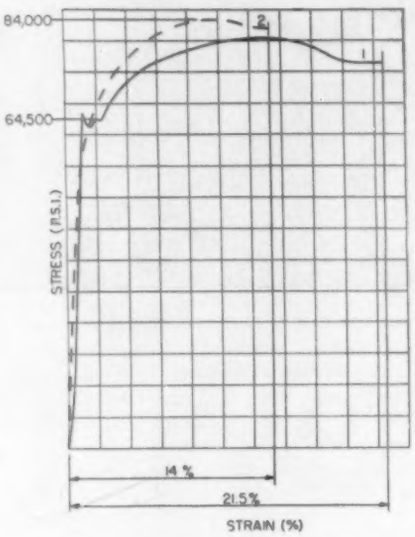


Fig. 1—Stress-strain diagrams of two standard (..505 in.) tensile test specimens.

An interpretation of the technical importance of

"Fish-Eyes" in Tensile Tests

★ Test results definitely indicate that "fish-eyes" are not welding defects—They are caused by variation in ductility of multi-layer welds

By BELA RONAY

Senior Welding Engineer, U. S. Naval Engineering Experiment Station, Annapolis, Md.

To those who are not familiar with the term, "fish-eyes" may be defined as small, conical cavities which appear singly, or in clusters, in fractures of all-weld metal tension specimens. While they are almost always present in specimens tested in the "as-welded condition," they are seldom noted in specimens tested subsequent to a thermal stress-relief. Fish-eyes are not defects, and it is for this important reason that they must be dealt with carefully. Fish-eyes, contrary to general belief, are not unavoidable in non-stress-relieved material.

For the purpose of this paper two assemblies were set up. Each consisted of ¾ in. mild steel plates machined along the kerfs at 30 deg., so that welding groove had an included angle of 60 deg. The root of assembly was spaced ¼ in. over ¼ in. x 1 in. mild steel chill bars. Both plate assemblies were 12 in. long. The same make, brand and size electrode was used throughout, maintaining the same current conditions as much as possible in manual welding by an experienced welder.

In filling in the groove of the first assembly, regardless of time elapsed between passes, no metal was superposed until the temperature of last deposited filler metal cooled below 150 deg. F.

The second assembly was welded speedily, keeping the interpass temperature at a minimum of 300 deg. F. Subsequently, assembly No. 1 was cut in two at right angles to the axis of the weld, yielding two all-weld-metal slabs. One of these was normalized, by being heated to 1800 deg. F., held at that temperature for 20 min., and then rapidly cooled by quenching in water. All three all-weld-metal slabs were then machined into 0.505 in. tension specimens. These were tested in the usual manner, procedure being recorded by stress-strain diagrams. Results of this test are given in Table 1.

The stress-strain diagram of specimens No. 1 and No. 2 are shown on Fig. 1, where the diagram of No. 2 is super-posed over that of No. 1.

Fig. 2—"Fish-eyes" in Specimen No. 1 tested in the as-welded condition.

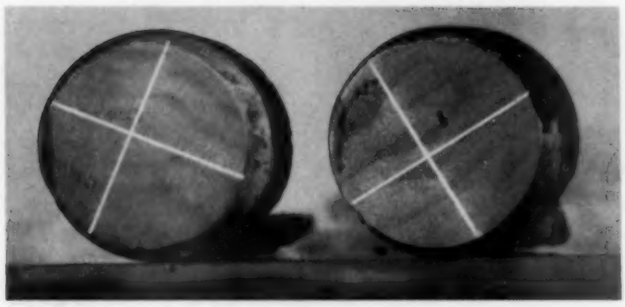


Fig. 3—Locating center line of most prominent "fish-eye" (shown in fracture, Fig. 2), on the macro-etched end of each half of the tensile specimen.

Table 1—Results of Tests on Standard Tension Specimens (.505 in.)

Specimen No.	Yield Point psi.	Tensile Limit psi.	% Elong. in 2 in.
1—150 deg. F. max. interpass temp.	64,500	81,000	21.5
2—Water quenched	56,000	84,000	14.0
3—300 deg. F. min. interpass temp.	62,000	75,000	22.5

A dotted line is drawn from the point representing the ultimate stress which developed in the material of specimen No. 2. Projecting this point upon the abscissa or the strain line, it is found that while the ultimate stress developed in the quenched material is higher than that of the "as welded," the strain (stretch) and the final plastic deformation of the former is considerably less than that developed in the "as welded" materials.

All three weld specimens were subjected to metallographic examination. Examination of the macrostructures was easily performed by polishing and etching the threaded end of either or both fractured halves of all three specimens. This examination revealed the following:

Specimen No. 1. The macrostructure of this specimen reveals striations composed of alternate fields of coarse and fine crystal formations. The striations correspond with the number and the relative position of the passes. The coarse crystal formations are located within the lower half of each pass.

Specimen No. 2. This shows a macrostructure of uniform composition.

Specimen No. 3. This shows a somewhat striated structure where the crystal formations representing each pass may be identified. The volume of coarse material is very small.

Examining the fractures of specimen No. 1, tested in the as-welded condition, several "fish-eyes" are revealed. These are reproduced in Fig. 2. The fracture of specimen No. 2 is some what irregular, but does not contain any "fish-eye." The fracture of specimen No. 3 approached the cup-condition and revealed two "fish-eyes," each about 1/32 in. dia.

Next, specimen No. 1 was taken and the center line of the most prominent "fish-eye" noted on the fracture was located on the macro-etched end of each half, as shown in Fig. 3. Thereupon each half was machined, removing all the metal above the scratch line, running roughly parallel with the stratum of coarse material in which the intersection of the two lines is located. On removal of the metal the machined surfaces were ground, polished and again macro-etched, revealing the cracks shown in Fig. 4.

Variation in Grain Structure

The coarsely striated macro-structure of specimen No. 1 reveals that it is composed of two types of metal, i.e., about 60% fine grained and the rest of coarse structure. The test results of specimens No. 2 and No. 3 reveal the physical properties of these two types of metal respectively.

The stress-strain diagram of Fig. 1 further indicate that were the two specimens tested simultaneously, specimen No. 2 would fail when the elongation of specimen No. 1 reached 62% of its ultimate value. This is the fundamental reason for the existence of "fish-eyes."

Fractures of specimens composed of coarse and fine-grained constituents should reveal "fish-eyes." A glance at Figs. 2 and 3 is convincing enough that the two conditions are closely related to one another. The macro-etched section of Fig. 4 show the cracks which developed within the coarse material transversely to the stress. The failure naturally occurs through the largest crack which opens into a typical shear cup.

Disposing of the fractured "all-welded" specimens by removing the metal layer by layer, by grinding and polishing and etching after each 1/16 in. or 3/32 in. thickness is ground off, will disclose transverse cracks in practically all coarse strata. As thermal conditions in manual welding are far from being uniform, the degree of coarseness of the striations, and their physical properties vary also. For this reason some striations show more cracks and form larger "fish-eyes" than others.

All-weld-metal specimens produced by an automatic welder capable of close control as to power input, arc stability, and rate of feed will show greater uniformity of crack distribution, provided that in course of deposition the required low inter-pass temperature is observed.

Occasionally "fish-eyes" are formed in line with small defects, usually pinholes. Along the lines of stress in whose path the pinhole is located, there is naturally a greater stress set up in the surrounding metal which is absorbed along the line by a portion of the metal, which while not necessarily coarse, may be of lesser ductility than the bulk of the metal above and below it. There the same phenomenon occurs as given for the coarse strata and results in the formation of a "fish-eye."

A thermal stress-relief treatment softens the material, and while it is not performed at a sufficiently high temperature to alter the grain structure, it results in partial spheroidization of the pearlitic constituent of the coarse material, thereby softening it to an extent that its ductility becomes almost the same as that of the fully recrystallized mass of the specimen. For this reason "fish-eyes" are seldom found in stress-relieved specimens and if they are

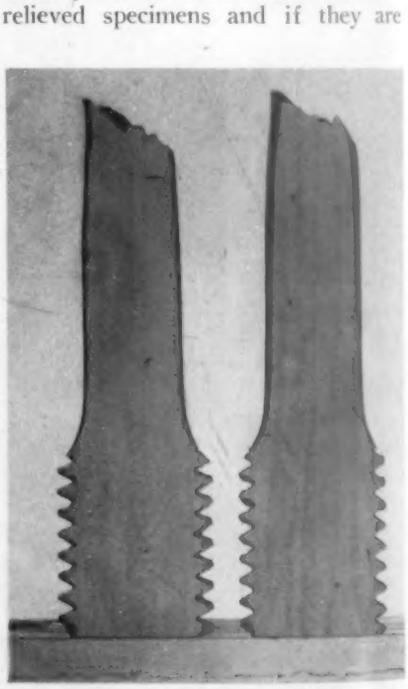


Fig. 4—All metal above the scratch line (Fig. 3) was machined off on both halves of the test specimen. Cracks as shown were revealed when these machined surfaces were ground, polished and macro-etched.

present their area is seldom larger than 1/32 in. dia.

The general belief that "fish-eyes" are more prevalent in weld metal deposited from organic electrodes is basically untrue. In general practice, organic electrodes are deposited at lower current rates than those covered with a largely inorganic matrix. It is but natural that when the interpass temperature is permitted to go below 300 deg. F., the volume of non-recrystallized material is greater in a deposit obtained from an organic covered electrode, than may be found in its companion deposit made with an inorganic type electrode of the same size, but deposited at a heavier current rate.

When companion specimens are produced, using the above given two types of electrodes, maintaining an interpass temperature of not less than 300 deg. F., both will produce weld metal practically free of coarse constituents. The fracture of test specimens obtained from the latter type deposits is practically free of "fish-eyes" even in the as-welded condition.

In conclusion, "fish-eyes" do not represent defects and shall not be adjudged as such. Their presence or absence is not a characteristic of the electrode used, but of the thermal conditions obtained in course of depositing the filler metal. Where the use of organic type electrodes is indicated by their greater adaptability to facilitate the work, there is no justification of substituting less flexible inorganic electrodes in the hope that the deposit obtained therefrom may be of greater soundness.

The transverse cracks shown on Fig. 4 do not exist in mild steel deposits prior to stressing, although they may develop when the filler metal is deposited under extremely adverse weather conditions. Consequently, it is evident that "fish-eyes" do not indicate defective material, nor are they harbingers of failure for structures loaded under normal stress conditions.

« »

Welding Of Zinc-Base Alloys— Also Known As "White Metal"

★Although a number of zinc-base alloys have been employed in the past for die castings, modern practice seems to have centered on three alloys covered by S.A.E. specifications 903, 921 and 925. The compositions of these alloys and some of their physical properties are given in Table A. The variations in copper content cause some variation in physical properties. While tensile strength is fairly high, it should be noted that ductility is quite low, 3 to 5% elongation in 2 in. This calls for careful attention to procedure when welding a broken die casting made of "white metal."

R. H. Ogden* suggests the following welding procedure in repairing of zinc-base die castings:

"Before trying for the first time to make a weld, the operator should practice on a worthless piece of white metal. Try flame adjustment, heat the part and note carefully the changes in appearance as it passes from cold to molten state. Also keep surface in plastic or flowing state, yet not allowing it to collapse. Use a bronze paddle (⅛-in. bronze welding rod) and work metal so as to become acquainted with its action.

"Vee the broken edges to about 45 deg., clean the surface of any plating or scale, back from edges of the vee at least ⅜ in. Welding from one side only is recommended. Never do any more welding than to just smooth up the job on the underside and then only after slightly veeing out the crack.

"A number one or number two tip is the size recommended, using 1 or 2 lbs. of oxygen and 5 lbs. of acetylene. Flame should be carbonizing (excess of acetylene) with only enough oxygen to keep flame from smoking or sooting the work. If flame does soot the surface, increase oxygen pressure slightly. Unlike a welding flame, there should be no inner cone present at the tip. If cone shows, eliminate by reducing oxygen pressure.

"Heat metal until it starts to flow. Turn flame parallel to surface, and with side of flame hold metal at this heat. Heat welding rod to same temperature, and then with both base metal and welding rod at this temperature, touch rod to the break and rod will flow into vee, thoroughly fusing. Repeat operation until break is completely filled. Be sure to kick rod into weld to break down skin resistance as filler metal will lay on surface and will not fuse if only heat is applied.

"Puddling is only necessary when operator has piled rod on top instead of fusing to base metal. Heat base and rod to flowing temperature and work latter into base metal using bronze rod as a paddle.

"The expansion and contraction of white metal is great and therefore it may be necessary to preheat certain castings. Use a ⅜ in. or ½ in. steel plate to set casting on and apply preheating torch to underside of plate,

R. H. Ogden demonstrates how samples of "white metal" can be welded, using an oxy-acetylene torch.

*President, Aladdin Rod & Flux Mfg. Co., P. O. Box 935, Madison Square Station, Grand Rapids, Mich.

Table A—Composition and Properties of Die-Casting Alloys

	S.A.E. 903	S.A.E. 921	S.A.E. 925
Copper	.10 Max.	2.50	.75 - 1.25
Aluminum	3.5 - 4.3	3.5 - 4.5	3.5 - 4.3
Magnesium	.03 - .08	.02 - .10	.02 - .08
Iron	.10 Max.	.10 Max.	.10 Max.
Lead	.007 Max.	.007 Max	.007 Max.
Cadmium	.005 Max.	.005 Max.	.005 Max.
Tin	.005 Max.	.005 Max.	.002 Max.
Zinc	Remainder	Remainder	Remainder
Tensile Strength, p.s.i.	40,300	47,900	44,500
Elongation, % in 2 in.	4.7	5.1	3.0
Brinell hardness	60 - 90	75 - 100	70 - 85
Melting Point (deg. F.)	717.6	715.1	717.1

heating same until plate starts to turn red. This will preheat casting sufficiently. Care must be taken to keep the preheating flame from playing directly on the casting. When welding is completed equalize heat in casting and turn off preheating torch.

"Aluminum castings should be vee'd and cleaned the same as white metal. Heat casting slightly before centering flame on break. While heating, brush surface with wire brush to break up surface oxide. When casting is heated sufficiently to flow rod without aid of flame, flow rod into break for tinning purposes and brush vigorously under heat. With sides thoroughly tinned, flow in enough rod to fill vee."

» «

Ohio State Offers Course In Welding Engineering

★ The recent Ohio State Welding Conference at Columbus, Ohio, May 11-12, focused attention on the four-year course in welding engineering which Ohio State now offers. "In view of the phenomenal strides of welding in all types of heavy goods industries and in the transportation field there are prospects that this branch of professional engineering will be stable for many years to come," according to Dean Charles E. MacQuigg.

Administration of the curriculum will be under the Department of Industrial Engineering, which for a number of years has presented the shop courses in welding required by various curricula in the engineering college. Entrance requirements are the same as for the other curricula of the college of engineering. Admissions will be in the hands of the entrance board at Ohio State, to which inquiries should be directed.

Welding engineering students will take the same work as other engineering students the first year, amounting to 58 academic hours. For succeeding years they will have the courses and hours listed: mathematics (calculus) 15; physics, 19; mechanics, 18; metallurgy, 7; economics and accounting, 16; mechanical engineering, 19; drawing (working drawings, technical sketching), 3; English, 3; electrical engineering, 8; civil engineering (trusses), 5; industrial engineering, 41; welding (applications), 14; mili-

Dean Charles E. MacQuigg

Table A—Summary of Academic Subjects Embraced in Four-Year Course

First Year (All Engineering Students)

AUTUMN QUARTER	Hrs.	WINTER QUARTER	Hrs.	SPRING QUARTER	Hrs.
College Algebra	(5)	Plane Trigonometry	(5)	Analytic Geometry	(5)
General Chemistry	(4)	General Chemistry	(4)	Qual. Anal. Chemistry	(4)
Engineering Drawing	(4)	Engineering Drawing	(4)	Descriptive Geometry	(4)
English	(3)	English	(3)	English	(3)
Elements of Engineering	(1)	Elements of Engineering	(1)	Elements of Engineering	(1)
Military Science	(1)	Military Science	(1)	Military Science	(1)
Physical Education	(2)	Physical Education	(1)	Physical Education	(1)
TOTAL	(20)	TOTAL	(19)	TOTAL	(19)

Second Year (Welding Engineering Students)

AUTUMN QUARTER	Hrs.	WINTER QUARTER	Hrs.	SPRING QUARTER	Hrs.
Calculus	(5)	Calculus	(5)	Calculus	(5)
Mechanics	(5)	Heat, Sound and Light	(5)	Economic Principles	(3)
Electricity and Magnetism	(4)	Economic Principles	(3)	Heat-Power Engineering	(3)
Forging, Shop Heat Treating, Welding	(3)	Electricity and Magnetism	(5)	Foundry Practice	(3)
Military Science	(1)	Military Science	(1)	Elementary Machine Work	(3)
TOTAL	(18)	TOTAL	(19)	Military Science	(1)
				TOTAL	(18)

Third Year (Welding Engineering Students)

AUTUMN QUARTER	Hrs.	WINTER QUARTER	Hrs.	SPRING QUARTER	Hrs.
Engineering Drawing	(3)	Strength of Materials	(5)	Accounting (Facty. Costs)	(5)
Heat-Power Engineering	(3)	Production Control Charts	(3)	Electrical Engineering	(4)
Mechanics (Statics)	(5)	Management of Men	(4)	Strength of Materials	(2)
Metallography	(3)	Electrical Engineering	(4)	Mechanics (Dynamics)	(3)
Outline of Accounting	(5)	Theory of Welding*	(3)	Elective Course	(3)
TOTAL	(19)	TOTAL	(19)	TOTAL	(17)

Fourth Year (Welding Engineering Students)

AUTUMN QUARTER	Hrs.	WINTER QUARTER	Hrs.	SPRING QUARTER	Hrs.
Advanced Strength of Materials	(3)	Advanced English for Engineers	(3)	Machine Design	(3)
Machine Design	(5)	Machine Design	(5)	Methods of Waste and Elimination	(4)
Elem. Production Control	(3)	Welding Design*	(3)	Advanced Welding Design*	(5)
Welding Engineering and Applications*	(3)	Advanced Metallography	(4)	Advanced Production Control	(3)
Civil Engrg. (Trusses)	(5)	Elective Course	(3)	Elective Course	(3)
TOTAL	(19)	TOTAL	(18)	TOTAL	(18)

*See note on next page.

tary science, 3. Nine hours of electives will also be permitted.

The curriculum seeks to supplement the training of civil, metallurgical, industrial, mechanical and other engineers, each with some of the training of the others. "Because of the rapid growth of welding and the special techniques involved, there has been little opportunity for the design practices to become rationalized. Until lately the operations have been largely empirical. In view of the quite involved relationships between the nature of the metal to be welded, the design of the joint, the practice used in manipulation of the torch or electrode, the nature of the filler metal, the heat treatment effects and other important factors, the routine production of welds has become a highly specialized practice," says Dean MacQuigg.

Two summer's work is required: Practical experience in an industrial organization, and two inspection trips, each a week long, are required during March of the junior and senior years. Not less than 9 hrs. of elective courses must be taken in departments outside of the College of Engineering. These are planned to develop the human side of engineering students.

The specialized courses which deal with welding theory and welding design are briefly outlined below:

THEORY OF WELDING—3 credit hours in junior year. Covers fundamental methods and principles of welding; selection of method and type of welding; welding symbols; metallurgy as it pertains to welding; laboratory demonstrations.

WELDING ENGINEERING AND APPLICATIONS—3 credit hours in senior year. This is a continuation of the course "Theory of Welding." It covers welding specifications, inspection and applications. Effect of welding on manufacturing processes and on construction.

WELDING DESIGN—3 credit hours in senior years. Covers welding design in mechanical and structural fields. Economic comparisons of welded designs and other methods of manufacture. Laboratory practice in computations and welding drawings.

ADVANCED WELDING DESIGN—5 credit hours in senior year. This course is a continuation of the previous course, "Welding Design" but with more complicated designs.

Fig. 2—Arcs combined with straight lines flanged on 7/16 in. plate.

Fig. 3—Sample of compound curves that are routine flanging operations in boiler shops.

Forming Of Steel Plate For Welded Fabrication

By HAROLD S. CARD

★ In the change-over from castings to built-up welded structures, designers of machine bases, frames, etc., have often felt at a disadvantage when the three-dimensional corner curvatures, so readily obtained in casting practice, were encountered. Even the simple curvatures that can be made in flat plate with the bending brake, were overlooked in some of the earliest ventures in welded fabrication, and one look at the awkward conglomerations of sharp angles was enough to tell designers that something was wrong. More recently fabricators have come to regard the heavy duty press brake as an indispensable tool. It combines the advantages of incorporating pleasing contours in designs and reduces the amount of welding and machining.

In order to get the same pleasing curves at corners and along the edges of formed plates, there have been developed a few ingenious devices which have given real satisfaction within certain limitations. The demand has been for a machine to do more advanced jobs of forming than are feasible with a set of long straight dies. Oddly enough, a highly satisfactory tool for this work had been developed and widely used elsewhere, long before its utility was adapted to the peculiar needs of general machinery fabrication—the pneumatic flanging machine, familiar to boilermakers.

A flanging machine, which has been in use for about two years in the fabricating shop of General Electric Company's River Works at Lynn, Mass., has the primary function of forming of parts for general machinery fabrication. The class of work on which

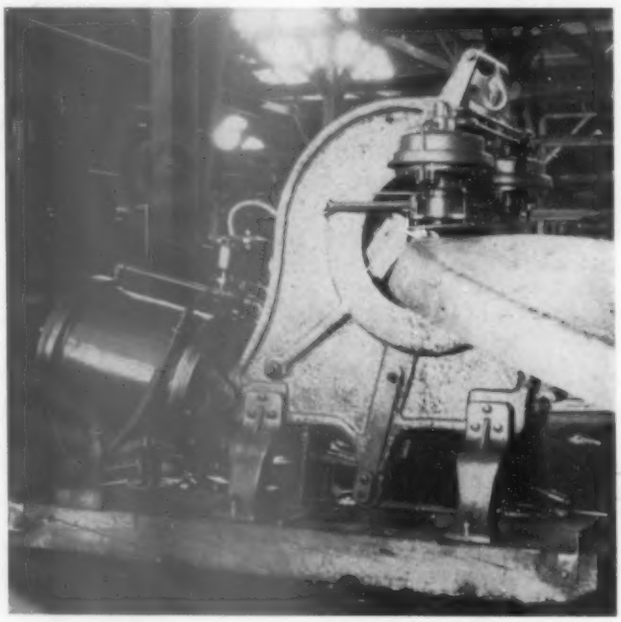


Fig. 1—Flanging in a complete circle around a dished head.

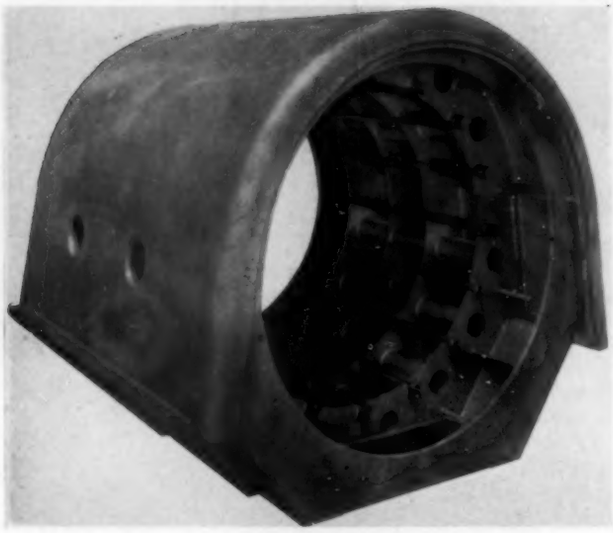


Fig. 4 — New design of stationary-armature frame. Note continuous wrapper plate and rounded-over end section welded to frame. Photo (General Electric Co.).

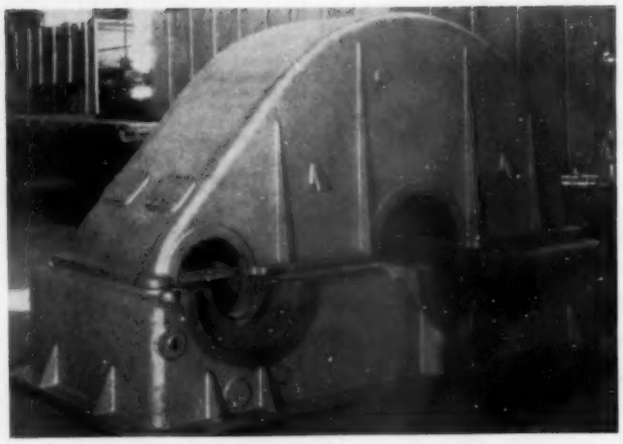


Fig. 5 — Casing upper and lower halves for single-reduction gear, 4000 KW, 3598 to 375 rpm. Photo (General Electric Co.).

nected to an air hose (100 lbs. pressure). Standard sizes will flange plate cold up to ¾-in. thick.

In Fig. 2 plate has been flanged in a combination of arcs and straight lines. The straight edges could as well have been converging instead of parallel. Tapered tanks have been produced in this manner for sugar refineries. The same operation performed on narrow rectilinear plates would produce the oil pans and chip pans for machine tools. Fig. 3 shows a familiar boiler shop job, a combination of straight lines with compound curves.

The remaining illustrations show how General Electric has taken advantage of the adaptability of these applications to a variety of machinery structures. Fig. 4 is an arc-welded stationary-armature frame for an a-c. turbo-generator. The framework is built up of parts cut from boiler plate with the machine cutting torch, and using longitudinal tubular members. Over this is the wrapper sheet, neatly flanged. The general design is worth noting because it combines great strength with minimum weight, and the smooth curves of the exterior are as perfect as can be obtained by any casting process.

Fig. 5 is a single-reduction gear casing. This is quite different from some of the early welded gear guards with right-angled corners and corner welds.

it is used is characterized by the most exacting requirements known to welding practice. The welders employed are carefully trained mechanics as well. The performance of this piece of forming equipment under such conditions has been highly satisfactory to the management and its range of usefulness has exceeded expectations.

Three of the applications of the flanging machine which are most commonly found in boiler and tank shops will indicate types of curved elements and combinations into which the usual run of machinery structures can be divided. In Fig. 1 the machine is flanging a dished head for a cylindrical shell. This is a cold forming operation. Heating is necessary only when the material is thicker than the normal capacity of the machine, or the radius of bend is very small. Questions that may arise regarding residual stresses due to cold working can be answered by the following experience. It has been found that when a head of this type has been cut into quadrants, the four parts will fit together neatly. The explanation given is that the metal is not drawn but bent.

Fig. 6 — Lower half of casing shown in Fig. 5. Photo (General Electric Co.).

On round work the method consists of suspending the plate from a hoist, inserting it into the machine the desired amount and feeding around step by step until the entire circumference is flanged to the desired angle. On rectangular work feeding is back and forth step by step. The flanger is self contained and requires no foundation and can therefore be readily moved to new locations if desired. It must of course be placed within the range of a crane for handling plates, and be connected to an air hose (100 lbs. pressure). Standard sizes will flange plate cold up to ¾-in. thick.

The flanger produces a much more pleasing contour and replaces corner welds by butt welds, which are more easily made and very dependable in service.

The economies of this innovation in forming plate for welding is not to be arrived at by a simple cost comparison between two methods of construction. It is rather a matter of making parts that are very difficult to cast successfully, on account of combinations of thick and thin sections, compared to the relative ease of assembly by welding.

Safe-Ending of Boiler Tubes

★ Approval of this widespread practice made dependent upon operator qualification tests

By FRANK PAGE*

Supervising Engineer, Boiler Section, California Industrial Accident Commission, San Francisco, Calif.

REMOVAL OF TUBES from fire-tube boilers for cleaning, de-scaling or repairing, necessarily involves slotting, chipping, or otherwise constricting the ends so that the tubes are rendered unfit for replacement in the boiler. As a result, a repair practice has become established which involves cutting off the ragged ends and welding onto one end of the tube a short piece of tube of the same diameter and wall thickness, which is of sufficient length to permit the tube to be refitted into the boiler. This practice is commonly termed "safe-ending," although the terms "piecing" or "re-tipping" are also sometimes used.

In the development of railroad repair shop work, the practice of applying these safe ends by forge welding became firmly established, so that safe-ends welded by this hammer welding process have throughout all code jurisdiction become universally acceptable. Such forge welded safe-ends have given satisfactory results and have proven reasonably safe, although they have not shown a perfect record because there have been some failures due to imperfect welds.

When fusion welding came into general use, there was a tendency to turn immediately to it as a solution of this problem of attaching safe-ends. Unfortunately, a number of failures occurred as a result of poor welding. In one case of a horizontal fire-tube boiler, where a shell plate failure occurred, all of the safe-ends ruptured at the welds and allowed one end of the boiler to be thrown some distance. In another case, a set of 42 3-in. tubes safe-ended by fusion welding were transported about five miles on a ¾-ton truck and, on arriving at the boiler, it was found that 40 of the 42 ends had dropped off en route. The net result was a complete distrust of fusion welded safe-ends. At that time the railroad repair shops introduced quite a number of resistance welders for applying welded safe-ends and this process has given an excellent record of both endurance and safety.

*Condensed from the author's paper presented at the recent I.A.A. annual meeting in Houston, Tex.

Early Practice

In California, there are many industries using steam boilers for power purposes that are located at great distances from cities or accessible sources of supplies. In these cases, judicious and well organized applications of fusion welding have been made to numerous forms of machinery repair and, as the proficiency of the welding operators increased, the tendency to extend it to boiler repairing has developed. At first, the practice of the California Industrial Accident Commission was to limit such applications to cases where the safety of the structure was not dependent upon the weld; however, the rapid advances in the welding art could not be ignored and it became evident that, with the advances that were being made in the various welding processes and in the dependability of trained welding operators, results could be expected that were well within reasonable and necessary requirements for safety. After a careful investigation of this particular repair practice, the Commission revised its boiler safety orders so that, effective January 1, 1936, the safe-ending of boiler tubes was rendered acceptable.

The application of fusion welding to this practice of safe-ending has been made dependent upon qualification of the welding operator as follows (Order 813-e): "On steam boilers, or their appurtenances, only welding repairs done by welders who, to the satisfaction of the Commission, have proven their ability to make sound and ductile welds in a position or positions in which the welding is done shall be accepted. All welds must be plainly stamped every 12 in. or less by the welder, with the identification number allotted to him by the Commission."

Operator Qualification

The making of the test specimen for tube welds must be witnessed by a certified boiler inspector and results reported in writing to the Industrial Accident Commission. The tests supposed to satisfy the requirements of Order 813(e) for both safe-ending of tubes and boiler repair work are based on the provisions of U-69 (so-called Class 2) welding of the A.S.M.E. Unfired Pressure Vessel Code. These requirements are shown in Appendix A.

The making of the test welds must be witnessed by a certified boiler inspector, who may make the nick and free-bend test or have them and the pull tests made by a testing laboratory, which must report the results of such tests in writing to the Industrial Accident Commission. If the results are found satisfactory, the Commission will allot a serial number to the welder with which he is to mark his welds as called for in Order 813(e) and register him as qualified to do repair work on steam boilers by fusion welding for

one year, except on change of employer or change of process or rod, or if revoked for cause.

In conclusion, I wish to call attention to the fact that boiler repairs must only be made on the recommendation and under the supervision of a boiler inspector holding a certificate of competency from the Industrial Accident Commission of the State of California. In the safe-ending of tubes, acetylene welding is used in practically all instances.

Appendix A

Annual Test for Qualification of Tube Welders to Safe End or Retip Tubes for Use in Firetube Boilers

(All Tests Shall Follow A.S.M.E. Set-Up for Class 2, Unfired Pressure Vessels)

The welder, who is to qualify for the above work, shall do so in the following manner in the presence of a boiler inspector holding a certificate of competency from the Industrial Accident Commission, California, to inspect boilers:

1. Safe end or retip three tubes or pieces of tubes, welding, preferably, one new and one used piece together. From each one of these welded pieces cut three strips. If the cut is made by a torch, the strip shall be 1 in. wide. If cut by saw or machine, the strip shall be ⅝ in. wide. Each strip is to be 10 in. long with the weld midway between the ends. Strips cut by torch shall be ground or machined to ⅝ in. width, removing approximately the same amount from both edges, to insure removal of all burnt material.

2. One specimen from each tube shall then be subjected to a free-bend test, one to a nick, and one to a reserve-bend test. The results shall meet the requirements specified for the kind of test. If satisfactory results are not obtained in all 9 of the specimens tested, then a second trial may be made in the test that failed. Failure to meet the requirement in the second test shall either bar the welder from a re-test for a period of six months, or call for a change in process, procedure, or rod, as may seem proper to the inspector witnessing the tests.

3. Free Bend Test—Grind well off flush with the surface of the tube metal on both sides of the specimen, then bend the ends to an angle of 30 deg. by gripping the piece in a vise 1¾ in. from the weld and striking light blows with a hammer, then place two very small prick punch marks in the weld 1/16 in. back from the edge of the weld, making a record of distance between centers of these prick punch marks. Then place the piece in a vise or strut in such a way that, on force being applied, the piece will take the form of a U with the weld in center of the round part of the U. Apply pressure until a crack appears in body of the weld between the punch marks, release the force and measure the distance between the centers of the prick punch marks with a flexible rule or piece of paper, or like thin material. Compare this measurement with that recorded while specimen was in the flat; the elongation thus found must not be less than 20% or one-fifth of the recorded measurement while in the flat.

4. Nick Break Test—No special preparation is called for on the specimen, except that a saw cut 3/16 in. deep shall be made in the center of the weld on both edges, leaving a ¼ in. wide piece of the weld to be broken. Place the specimen on supports, and strike a sharp blow in the middle on the weld, either under a steam hammer or by a sledge hammer or falling weight of sufficient intensity to cause a sharp sudden fracture of the specimen through the nicked part. The fracture shall show a fine fibre structure free from slag, imperfect, or lack of fusion, and shall not contain more than one (1) gas pocket, and this shall not be over 1/16 in. in length.

5. Reverse Bend Test—Grind off weld both sides flush with the surface of the tube metal, and prepare the specimen for bending the same as for the free-bend test, and bend in like manner, except the bottom of weld on inside of tube must be on the outside of bend; the bending must be continued until the piece has assumed a U shape. If a fracture occurs in the weld, the weld shall show at least 75% of penetration. Should the fracture occur in the area bonding the weld and the parent metal, or the weld lack in penetration, then such test shall not be accepted.

6. All the above tests must be witnessed by the inspector who witnessed the welding of the specimens. The tests may be made in any shop equipped with the necessary tools, such as an emery wheel, a vise and a sledge hammer. The inspector shall fill out and forward without delay a report of the test to the Industrial Accident Commission on forms provided.

» «

The Trend Is Toward Welded Steel Buildings

By VAN RENSSELAER P. SAXE*

★ In buildings of three or four stories where there is no danger of sway during erection, we have found it most economical to shop weld supporting beam seat members with sufficient welding to support the entire beam reaction, using only two bolts in top and bottom of connection angles. No field welding is required. This is similar to the average riveted column seat, field bolted job. If it is desired to get a more rigid structure, the flanges of beams can be field welded to the supporting seat members. We have found angles of proper thickness to be the most satisfactory seat support, and in cases where sufficient weld cannot be secured on the angle, vertical stiffener plates (Fig. 12) can be welded to the underside of the outstanding leg of the angle, so that any heavy load can be properly supported. We have tried seats of split beam sections, and seats of horizontal plates with vertical stiffeners, but in spite of much care it is difficult to prevent warping under welding heat. Time consumed in straightening or planing the top surface to get a true bearing for the beam makes them more costly than angles which rarely get out of shape.

For buildings requiring a more rigid construction, I prefer the type of connection in which a light angle is used as a seat for erection purposes only, and the beam web is welded direct to the supporting member. In this type of connection, care must be taken to secure a heavy weld which should be placed on the lower portion of the web and of sufficient thickness so that deformation due to beam deflection will take place in the web of the beam and

*Consulting Civil Engineer, Baltimore, Md.—This is the second and final installment of the author's article. First section was published in the May, 1939 issue, pages 24-27.

Fig. 9—A welded truss built with split I-beams (structural tees) in top and bottom chords.

Fig. 10—An 18-story welded steel building of rigid frame design.

not in the weld (Fig. 13). Welding is such a versatile agent that it permits a wide variety of good connections.

I have attempted to explain the methods and practices I have found to be most satisfactory from facts obtained from actual job experience. For the purpose of arriving at costs, we figure that under ordinary conditions, a 3/8 in. fillet weld costs 40 cents per lineal foot, using 5 to 6 ft. per hr. for the shop welding, and between 60 and 70 cents per ft., using 3 to 4 ft. per hour on a union field job. These figures include helper's and engineer's time required with the welder.

Easier Shop Assembly

Shop requirements for assembly of a welded job are much simpler than for a riveted job. One of the costs of riveted assembly is the making of templates for proper location of punched holes. Except, for the small detail connection angles required in a welded job, such templates are not usually required. Where the welded erection seat is used no templates are required. Clamping devices are used in welded fabrication. To punch holes for riveted connections, the material has to be handled through the shop and detail fittings must be securely shop bolted in place before rivets are driven. The bolts are later removed to drive the final rivets. All such work is done with little or no movement of the heavy pieces such as columns and beams from the immediate place in which they are unloaded from cars. One of our first welded jobs was completely fabricated on temporary platforms built along side of cars from which the material was unloaded. From this platform the finished material was loaded directly into the cars for reshipment. This can be accomplished by any fabricating shop at a considerable saving in costs over handling methods required for riveted work.

Erection Costs

Field erection costs, using union labor and field erection bolts for the multiple-story welded beam and girder building, averages about the same as for a riveted job. We have had jobs where, due to the lower cost of shop welding compared to riveting, in a properly organized shop, and where there has been a proper study of detail

Fig. 11—Example of welded angle seat connection.

Fig. 12—Seats made of split beams and horizontal plates with vertical stiffeners.

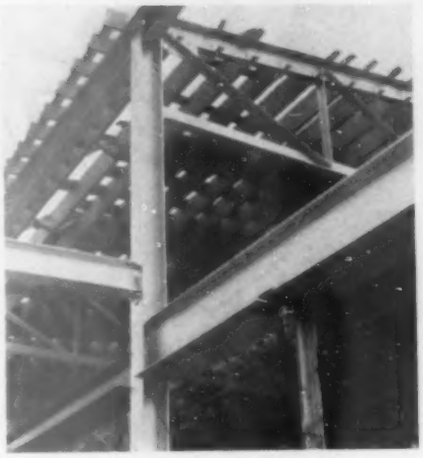


Fig. 13—Examples of welded web connections.

connections, a welded multiple-story structure is more economical than a riveted job by two or more dollars per ton. On this type of structure, when we use the erection seat, we have had figures running as high as $5.00 per ton under a similar riveted job.

For the factory type of building, where welded trusses or girders are used, we have never had a welded structure that did not save at least 15% of the cost of a similar riveted structure. We developed this from taking figures on both types of design for the same buildings and it is work of this character that the engineer should particularly investigate if he wants to give his owner the benefit of this most economical method of construction.

Do not use welding in combination with rivets unless the welding is completed before the rivets are driven. There is sufficient evidence to indicate that welding tends to loosen or pull rivet shafts when they are used in a joint capacity.

Conclusions

In conclusion, engineers should realize that in the past few years many improvements have been made in the art of welding. We have better operators, better machines and better welding rod material than was in general use even five years ago. As one who has worked with this material for a number of years, I can give assurance that it is a stable, safe and economical process of fabrication. I urge those men who are interested and those who are mildly interested to look into the process and find out what can be accomplished by its use, and try it.

Factors Governing Selection Of Weld Grinding Equipment

By R. M. GASTON*

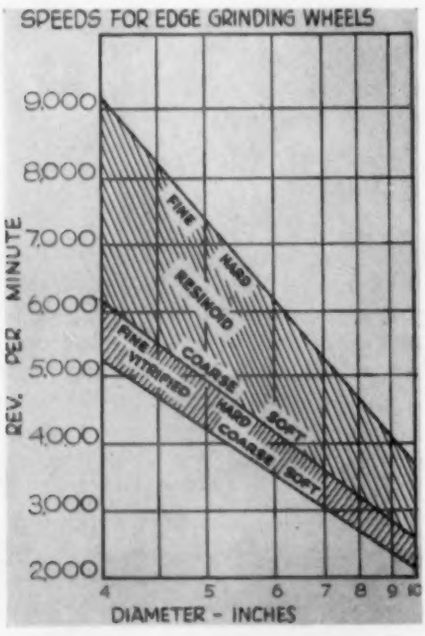
★Grinding is the hardest work required of any portable tool. Grinding may require continuous high speed and high power for hours in a stretch. Free-hand grinding can often use up to three horsepower, but usually one or two horsepower is sufficient. Grinding is fundamentally a high-speed operation as the wheels cut better at high speed and wear much longer. Hence grinding should be done at the highest speed which is safe for the wheel.

Best grinding results are obtained when using grinders of constant-speed performance. Any type of driving motor which overspeeds without load is not efficient as it cannot provide full grinding speed when grinding. A driving motor which depends on a governor for limiting the speed is a hazard when the governor fails to act.

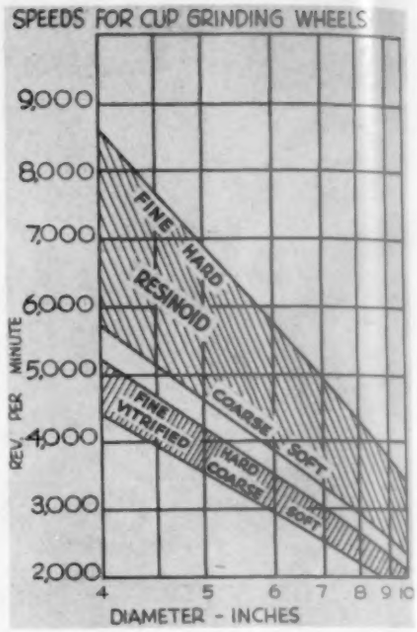
The air of grinding rooms is filled with abrasive and metallic dust, which is harmful to motors and bearings. Motors which are cooled by passing air through their windings should be replaced by motors enclosed in dust-tight cases. All bearings should have effective dust shields. Bearing and gear lubrication should never be attempted in the grinding room. Modern portable grinders are able to run for many months without new lubrication. This can be attended to when the machine goes to the toolroom for new cords and switches.

A portable grinder for a welding shop should be truly portable. Large work may require the operator to walk several feet to finish a cut or he may have to work from a scaffold. Full portability is secured when the grinder is a compact unit, within the weight limit, which can be handled by one man. The machine weight limit for different classes of work ranges from 12 to 25 lbs.

*Member of American Society of Tool Engineers and chief engineer of Gastón Power Tools, 2657 West 95th St., Evergreen Park, Ill. This is the concluding section of the article on "Weld Grinding Equipment" which appeared in the May, 1939 issue, pages 28-30.



Relation between wheel diameters and r.p.m. of wheels for edge grinding wheels.



Relation between wheel diameters and r.p.m. of wheels for cup grinding wheels.

Cost Factors

Portable grinders are most economical, when they require no air compressor and no special generators for their operation. The use of such auxiliary equipment entails more expense and inconvenience than is at first apparent. The expense includes the first cost, low operating efficiency, and maintenance expense. In actual practice such auxiliaries must operate at inefficient loads much of the time, and may cause shutdowns of all portable grinding equipment in case of failure. They should not be used when it is necessary to work overtime with a small number of grinders.

The cost of electric power for driving special generators for portable grinders may run as high as four times the cost for power for grinders operating directly from the regular electric power circuit. The cost of electric power for driving air compressors for air tools runs as high as ten times the cost for electric tools using regular power circuits.

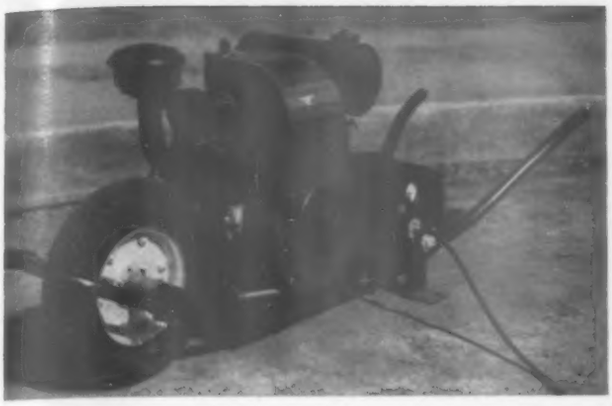
When grinders use regular electric power the grinding department can be started with a small investment for one machine. Capacity can be increased by adding one unit at a time as required, with no reference to the remainder of the grinding equipment.

In this article it is assumed that the shop power circuit furnishes 3-phase, 60-cycle current at about 230 volts. This is the most common power current in the United States and is usually favored by most public utilities. When large plants use 3-phase, 60-cycle current at 460 volts, it can be easily reduced to 230 volts for supplying portable grinders.

These 3-phase currents permit the use of portable grinders driven by the same type of induction motor which has proved to be so reliable for driving other types of shop machinery. While this type of portable grinder has been available for many years it has recently been much improved and is now furnished with motors enclosed in dust-tight cases. These new grinders can be obtained in several models.

While most grinding must be done with edge-grinding wheels, they have several faults. As soon as an edge-

Disc type grinder (3400 r.p.m.) with 7 in. steel-backed wheel.



Portable power plant for grinder application in the field.

grinding wheel is worn its surface speed is reduced so as to reduce its original efficiency, unless it is transferred to another machine operating at a higher rotative speed. In many cases this is good practice and is recommended. Free-hand grinding with edge-cutting wheels may leave irregular marks and they should not be used for finishing flat surfaces.

Cup and disc-type grinding wheels will make a flat surface smooth more quickly than any other type and in many cases one pass will produce the final finish required. A worn disc-type grinding wheel has the same diameter and efficiency as a new one. It is never necessary to change the rotative speed to wear the wheel down to the metal back plate. Very little abrasive material is discarded, when a disc wheel is replaced.

Spark Hazard

A modern resinoid grinding wheel is quite safe when driven by a constant-speed induction motor. A new danger has been found in the heavy shower of sparks, which may be projected for 20 ft. or more. This presents a fire hazard and danger to nearby workmen which cannot always be avoided by the use of ordinary wheel guards.

A wheel must be kept true and balanced to do its fair share of work. A bumpy wheel wears out both the machine and operator. Grinding wheels for portable grinders should be more carefully balanced than those used on pedestal grinders.

When a grinding wheel is working properly very little pressure is required to keep it cutting. It should wear just enough to remove the dulled cutting points, and not waste active abrasive material. Under these conditions 1 lb. of abrasive material should remove about 10 lbs. of soft steel.

Different types of work require

Finishing welded piping with wire brush, flexible shaft driven.

grinding wheels of different specifications. If a wheel glazes and cuts too slow the operator should try a softer grade. If a wheel wears too fast it may be possible to use a harder grading without trouble.

The modern portable grinder may use up a wheel every eight hours. But if the wheel has been used effectively it has removed several times its weight in steel. Don't blame the grinding wheel, but be sure that you are using modern shop methods.

Polishing Stainless Steel

In finishing stainless steel the object is to match the original finish or to change the original finish to meet the customer's preference. The following suggestions are offered in polishing stainless steel:*

1. Avoid heating the work. Temperatures above 150 deg. F. will cause wrinkling, buckling and discoloration.

2. Before using a new belt, disc, flap, or sleeve, always break it in, for a short time, on a scrap piece of material the same metal as that on which the tool will be used.

3. Manipulate the tool in such a manner that gouges, chatter, circular, and herringbone scratches will not be produced. Keep scratches parallel and straight.

4. Set the tool down on the work in a stroking motion and lift before reversing stroke. Keep stroke speed uniform and do not dwell in one spot.

5. If one section of a belt, or some part of a disc face, receives more wear than the balance of the active area and the comparatively fresh portion is suddenly thrown in contact with the work, two distinctly different appearing scratches will result. Be sure the abrasive is used uniformly.

6. For speed and economy, use coarsest grit size possible consistent with finish.

7. When making tests to determine grit size, never compare finishes with a fresh abrasive. For example, a used No. 120 belt may produce a finish comparable to a new No. 150. This is a natural result to be expected of any finishing abrasive tool. After elimination of the initial high cutting rate, a slightly used belt or sleeve will produce a finish corresponding more closely to that produced in the mill.

This, however, does not apply to discs, for the reason that the line of attack of abrasive grains on a disc is parallel with

Surface finishing with aid of flexible shaft unit.

the work which leaves a long scratch having an abrupt beginning and ending; whereas, the line of attack with a circular tool is more or less through an ellipse, the length of scratch depending to a great extent upon compressibility of the cushion material on which the abrasive is mounted.

8. The first application of a lubricant or compound to new abrasives should be thorough and uniform. This is best accomplished with the tool stationary. Subsequent applications may be safely made with the tool in motion.

9. Do not attempt too much work with a fine grit number. If considerable stock must be removed to reach the bottom of a mark or a coarse scratch, do so in gradual abrasive steps. For example, it may be necessary to remove a deep tool mark or effects left by a hard grinding wheel. To reach the bottom of the mark, considerable material must be removed. This would be accomplished more economically and with less heating of the work if done in steps with No. 60, No. 80, and No. 100 abrasives rather than to do it all with No. 100 for the reason that the fine number, having less capacity than the coarser, would be relieved of any work, except that of removing scratches left by the preceding coarse numbers.

*Taken from a publication issued by Minnesota Mining and Mfg. Co., St. Paul, Minn.

New Designs Recommended For Structural Rolled Shapes

By F. J. WILHELM*

★ In my opinion, engineers have not utilized the present types of standard structural shapes as shown in Fig. 1-A to the fullest extent in fabrication of welded machinery. This apparent hesitation is no doubt due to the fact that these shapes do not provide the rounded streamline contours which are so much desired in present day machine design.

In my opinion, we will soon have available structural shapes of the types shown in Fig. 1-1. These will be rolled or formed in convenient weights, sizes and lengths so that the engineer can design almost any type of machine bed in the modern trend. They will enable him to provide that pleasing effect which the purchaser of welded machinery is anxious to obtain. At the present time an engineer desiring to use a streamline design is compelled to employ rolled steel plate and form it in the

*Dayton Fabricated Steel Co., Dayton, Ohio.

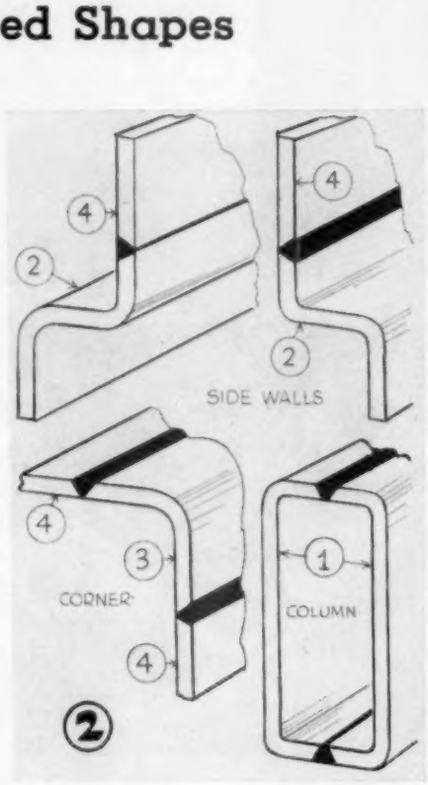


Fig. 2—Application of proposed new rolled shapes to a new type of machine bed side wall and base, also a corner and side wall.

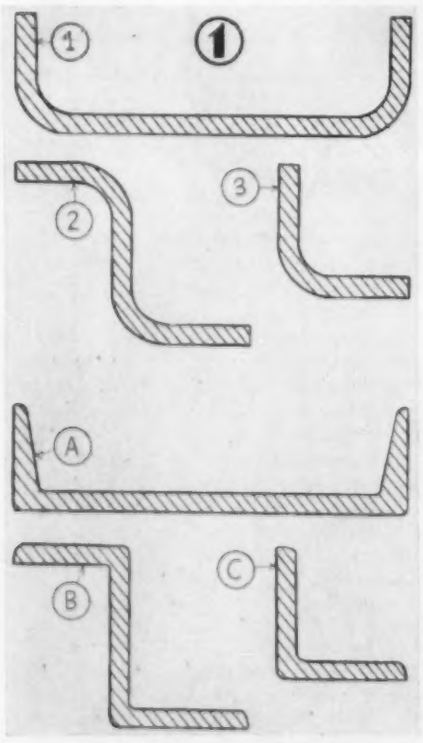


Fig. 1—(1, 2, 3) Proposed structural shapes for application in machinery fabrication. Fig. 1—(A, B, C) Standard types of rolled structural shapes now available.

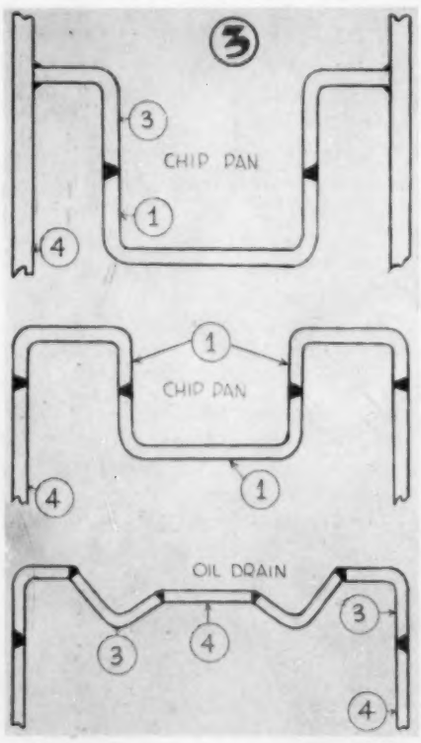


Fig. 3—Fig. 3—Cross-sections of three types of construction employed on machine beds. With the proposed shapes there are a number of design possibilities.

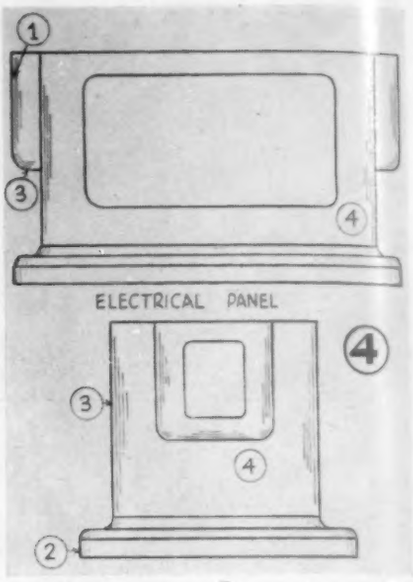


Fig. 4—Machine bed design utilizing all three of the proposed shapes, together with rolled plate.

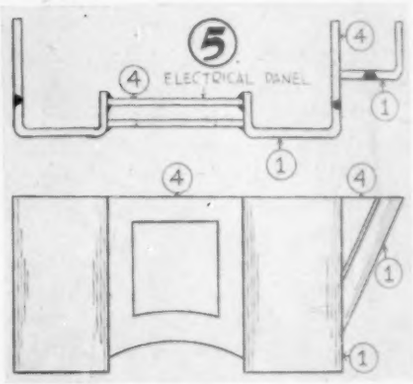


Fig. 5—How these shapes can be used in forming an electrical panel or compartment. This sketch merely suggests some of the various designs which are possible.

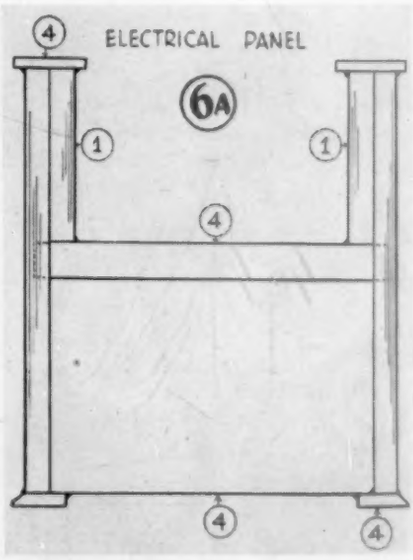


Fig. 6-A—A special machine frame obtains rigidity in side columns through use of welded box sections fabricated from two rolled channels.

fabricating shop. While this is entirely practical it increases the cost as compared to the cost of fabrication using pre-formed sections. In my opinion, the present rolled shapes are too limited for present day designs. The illustrations and captions describe a number of possible applications of the suggested new shapes.

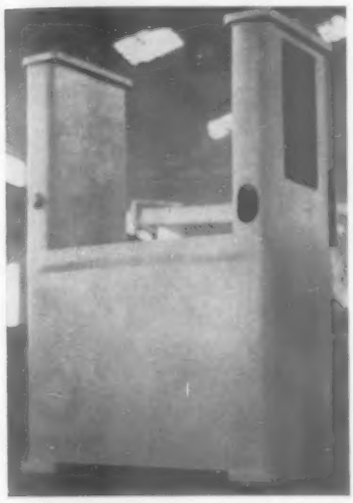


Fig. 6-B—Photograph of same machine completely fabricated. Chutes for chips and also oil drains were built into the rear to give front of the machine a smooth clean appearance.

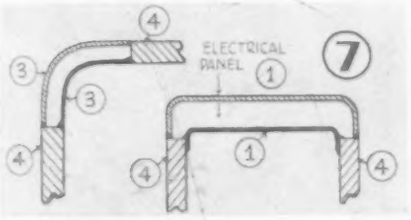


Fig. 7—Suggested use of two of the proposed structural shapes to be used where heavy plate sections are joined.

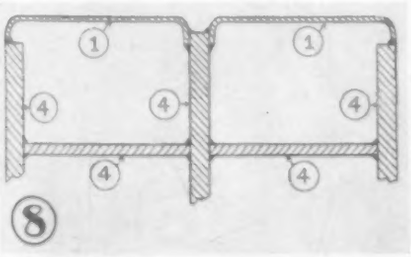


Fig. 8—Another idea incorporating the proposed channel shapes with heavy plate sections.

NICKEL AND NICKEL-BASE ALLOYS—International Nickel Co., 67 Wall St., New York City, has revised its Bulletin T-13, which covers nickel and nickel-base alloys and their use in the design of corrosion-resistant equipment. The text has been enlarged and, for some sections, rewritten extensively; and the tables and curves have been revised to include the latest available information.

Readers' Question Box

With this issue we are establishing a new feature in THE WELDING ENGINEER designed to help our readers solve some of their difficult welding problems. Whenever problems of general interest are encountered in the correspondence we receive regularly from our readers, these problems will be presented for solution in this new department. THE WELDING ENGINEER will pay $5.00 for the best replies received and accepted for publication. Replies should not exceed 500 words. We will prefer to use extremely brief replies, approximately 250 to 300 words.

» «

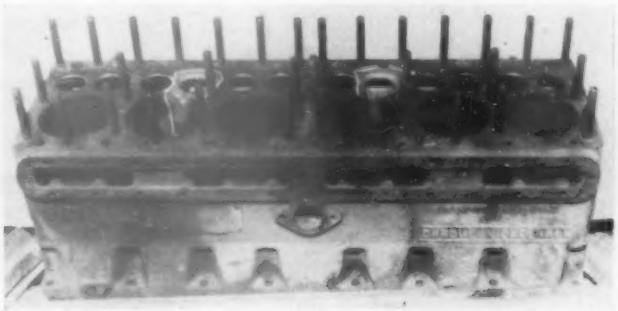
Welding Alloy Cast-Iron Cylinder Blocks

By A. F. MORTON

★ In our shop we have encountered a difficult welding problem in connection with cylinder blocks made of an alloy cast iron containing chromium and nickel. As shown in the photograph, these blocks come into the shop with a crack reaching down into the cylinder bore about 1 or 2 in. and up over the top face of the block, through the valve seat and down into the valve port. The crack usually stops at the valve guide hole. We find that this alloy cast iron is difficult to melt more than about ⅛ in. below the surface and none of the regular cast iron fluxes seem to work. Moreover, when we think we have done a good job, we find that the block will not stand up in service for any great length of time. We follow the usual recommended methods of preheating up to a cherry red and then post-heating after welding and allow the block to cool overnight.

On all jobs of this nature which we have attempted to repair, we encountered trouble with blow holes and hard spots when the blocks were machined.

We have used stainless steel 18-8 rod with quite a bit of success on some motor blocks and cylinder heads, but have never used it for repairs in the areas shown in the photograph. To my knowledge there is no steel rod on the market that will make a watertight machineable job in the area marked. It seems that when we use an ordinary cast iron rod it merely sticks to the base metal and does not properly fuse with it. However by using a rod known as Fusewell *22*, we have been able to melt the chrome nickel alloy, but we have not yet had enough experience with this rod to be definitely sure that it will lick the problem. The first job to which we applied Fusewell *22* withstood a 50 lb. hydrostatic pressure and was machineable.



Welding difficulties are encountered in the zones marked by chalk lines. Cylinder block is an alloy cast-iron containing chromium and nickel.

Flame hardening a carbon steel lathe spindle, 63 in. in diameter. Photo courtesy of (Westinghouse Electric & Mfg. Co. and Air Reduction Sales Co.).

Brief Sketches of Welding Jobs

Fig 1—Examples of spinning bushings: (A) Worn by dirt and grit; (B) New bushings; (C) Hard-faced with thin overlay of Stellite.

Thin Overlays of Hard Alloys Lengthen Life of Spinning Bushings

★ It may sound incredible to some of our readers that woolen yarn passing through a high-carbon steel bushing in a spinning frame creates enough abrasive wear to cut deep grooves in the steel. Well, seeing is believing. The evidence is shown in Fig. 1 (A) which depects a number of these small steel bushings which have been worn by the dirt and grit enmeshed in the fibers of the yarn used in the manufacture of rugs. These particular bushings were taken from a spinning machine in the modern daylight plant of the Olson Rug Co., 400 West Diversey St., Chicago. This concern is a leader in the rug industry and noted for its modern manufacturing methods.

A number of alloys have been tried out on an experimental basis in the Olson plant to find out what type of hard facing is most suitable. Haynes Stellite has been used successfully and also stainless steel overlays. In discussing this subject with the plant engineer, we learned that the greatest advantage of hard-faced overlays is the reduction of idle machine time when bushings get worn too much by the abrasive action of the yarn. The overlay can be placed on the steel bushing after removing it from the U-shaped spinning frame (Fig. 2).

In applying the Haynes Stellite, the welder takes a ¼ in. rod and draws it down to a 1/32 in. filament with the aid of his torch. This thin filament is then used to make the hard-faced overlay on the top of the bushing. If an attempt is made to use a thicker rod, the alloy runs over the top and partly down the sides, which is objectionable.

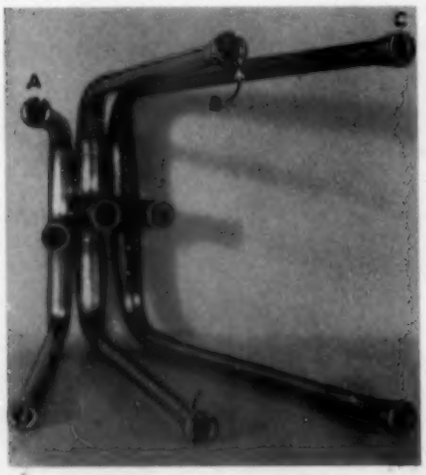
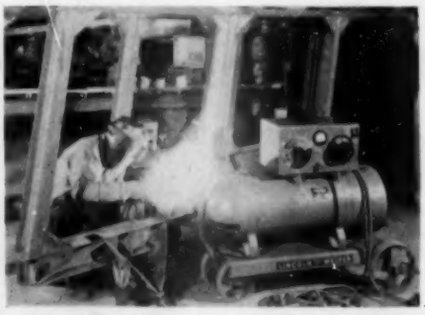


Fig. 2—Bushings mounted on U-sharped spinning frame: (A) New bushings; (B) Worn bushings; (C) Hard-faced bushings.

» «

300 British Bombers Being Built At Lockheed Aircraft Plant

★ The Lockheed Aircraft Corp., Los Angeles, California, has under construction 300 reconnaisance bombers for the British government. The order totals $25,000,000. In Fig. 1, a Lincoln Electric arc welding machine is being used to fabricate a jig for constructing the plane fuselages.



Fabricating a welded jig used in building plane fuselages. Photo (Lincoln Electric Co.).

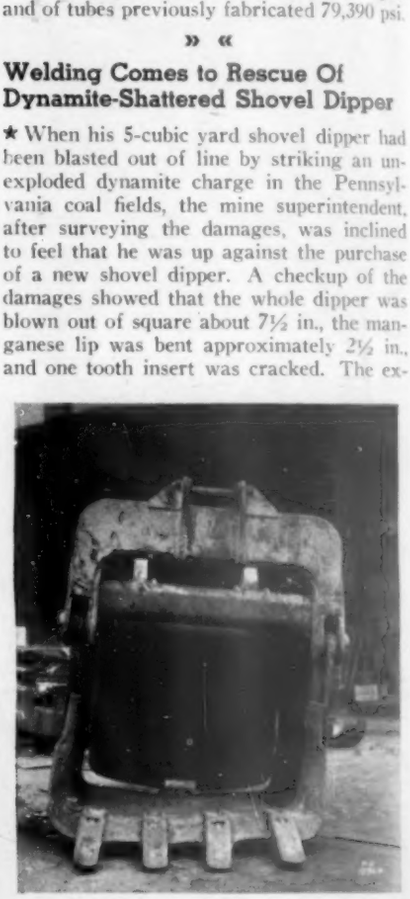
In addition to fabricating the jigs used in production of planes, arc welding is used to construct landing gears, motor mounts, etc. This process was adopted by Lockheed officials following exhaustive tests which proved that this method of joining metals provides greater structural strength and at the same time, greatly simplifies production. For example, the company found that the average fabrication time of an airplane landing gear fork by the former method was 16 hours; by arc welding, it was 8 hours, representing a factory saving of $20 per fork. Two landing gear forks per plane means $40 saving for each plane produced, compared with the former method.

Comparing, by actual tests, structural strength obtained by arc welding and by the former method, C. R. deLaubenfels, research engineer of the company, reports that arc welding provides joints 23% stronger than the former method. Actual specimens of welded tubes tested (tubes are used in fabricating the landing gear forks), showed tensile strength of arc welded tubes 98,160 psi. and of tubes previously fabricated 79,390 psi.

» «

Welding Comes to Rescue Of Dynamite-Shattered Shovel Dipper

★ When his 5-cubic yard shovel dipper had been blasted out of line by striking an unexploded dynamite charge in the Pennsylvania coal fields, the mine superintendent, after surveying the damages, was inclined to feel that he was up against the purchase of a new shovel dipper. A checkup of the damages showed that the whole dipper was blown out of square about 7½ in., the manganese lip was bent approximately 2½ in., and one tooth insert was cracked. The ex-



This dipper was blown out of square about 7½ in. No weld failures were evident. Photo (Harnischfeger Corp.).

Reconditioned at the factory, the dipper was returned to service at a saving of 40% of cost of new dipper.

plosion evidently occurred on the left side (when facing the dipper) directly under the bail hinge. The bail was twisted, and there was a break in the weld between the lip and shell on the left side. This weld did not fail, however, until the lip had been bent 2½ in. out of line. In spite of the distortion of the dipper in general, there were no cracks in the dipper door or shell other than those between lip and shell.

The dipper was one of the new, all-welded type, manufactured by Harnischfeger Corp., Milwaukee, Wis. When inquiring about the price of a new dipper, the superintendent was informed that though the job had never been attempted before, it would be cheaper for him to have the shattered dipper repaired than to buy a new one. The dipper was returned to Harnischfeger Corp. where skilled operators used kerosene torches to force it back into shape. Then, using a P&H-Hansen arc welder and Smootharc "Har-Ten A" welding electrodes, they put it into good condition, with a saving of about 40% of the first cost of a new dipper. All welds were locally stress relieved.

» «

World's Largest Elliptical Heads For Welded Coke Chambers

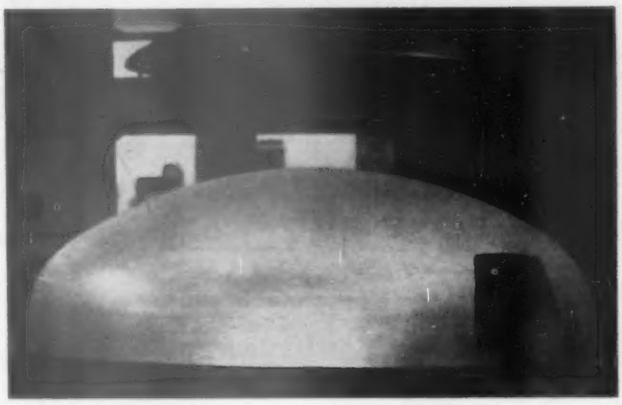
★ For A. O. Smith Corp., Milwaukee, Wis., the flanging department of Lukens Steel Co., Coatesville, Pa., recently formed 8 elliptical heads, meeting requirements of the A.S.M.E. Code. Each head measured 13 ft. in inside diameter, 2⅛ in. minimum thickness, and weighed 23,460 lbs. Inside overall depth was 41½ in. and straight flange about 2½ in. Flat circular plates 198½ in. in diameter, 2½ in. thick were required.

The heads, with shell plates, were used in fabrication of four refinery coke chambers designed to operate at a pressure of 150 lbs. per sq. in., and a temperature of 900 deg. F. Each vessel weighed about 275,000 lbs.

Following the rolling operation, the plates were transferred to the flame-cutting department. From each rectangular plate, a circular plate was flame-cut, measuring 198½ in. in diameter, weighing 23,460 lbs., or about 42% of the weight of the ingot from which the plate was produced.

After heating to the proper temperature in a furnace adjacent to the spinning machine, the circles were given the first forming or turndown operation. The circles were centered on the spindle or vertical axis of the spinning machine and secured by two flat formers. As the circle revolved at the comparatively slow speed of 20 r.p.m., a quadrant roller working at various angles from the horizontal towards the vertical, gradually forced the outer 20 in. of the circle downward into a skirt.

First forming operation at slow speed. Quadrant roller forces downward to form skirt.



Finished head, edges turned and flanged, central portion pressed to elliptical shape.

Following this initial operation, the circle was removed from the spinning machine and re-heated prior to dishing. During the re-heating period, the spinning machine was equipped with elliptical formers for dishing. In this step, the flat, central portion of the head was formed into elliptical shape by application of vertical pressure, giving the head a central elliptical section with radius of 132 in., surrounded by a flared skirt about 30 in. long. At this point, spinning was again begun to finish forming of the corner, with the quadrant roller forcing the outer edges of the head downward toward the vertical. In this operation, a specially designed inside radius roller weighing 4,000 lbs., was employed, producing an inside curved surface of 25½ in. radius between the central elliptical section and the vertical sides of the head.

After this lengthy operation, it was necessary to re-heat the heads before the final operation of flanging and dishing, in which the quadrant roller and the inside radius roller molded the metal at the extreme outer edge of the heads in a vertical straight flange.

Before shipment the circular edges of the heads were machined with a U-bevel for welding into the finished coke chambers.

Beveling 54,720-lb. ingot by use of flame cutting to prevent "over-roll," or hollow edges.

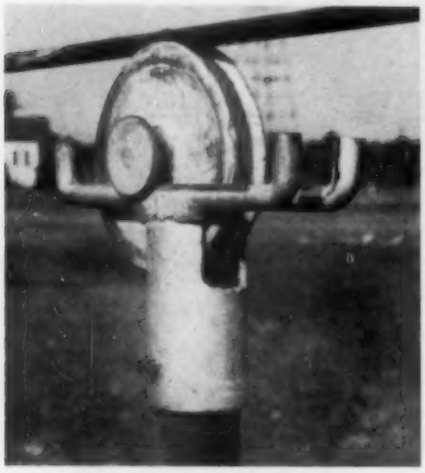
Flame-cutting a circle 198½ in. in diameter from plate 2½ in. thick.

» «

Welded Carrier For Pull-Rod Roll

By M. T. PATE

★ Fabricated entirely by welding, with the exception of drilling and tapping for the ½-in. locking set screw, a sturdy and quickly adjustable support for oil well pumping rod lines carries a wooden differential roller.



Welded support for oil well pump rod line.

Built up on a base of 3-in. pipe, with two U-sections cut in the top for wheel clearance, the two rods serving as wheel tracks were heated and bent to shape by the welder, and then mounted on the extending sections of the pipe, after the clearance slots had been cut. Formed in one piece by welding, there is nothing to work loose and cause premature rod failure. With only rolling friction, the life of the unit may be expected to survive the life of the well.

» «

Repair of Damaged Threads

By L. A. SEVERTS*

★ Having several shafts with damaged threads that had to be repaired without benefit of a threading die, we devised the following simple method and have used it to good advantage several times. After cleaning up enough thread with a file to start the nut on the shart, proceed as follows:

Get a short length of 3/16 in. sq. high-speed tool bit. Grind this bit to 60-deg. point. Small scrap pieces may be used that are too short for other purposes. If it is a large nut it is advisable to make a tool holder as shown. Then tack weld this holder to the nut and fit point of tool into bottom of threads as shown in Fig. 2.

By turning the nut onto the shaft it is possible to restore the thread. When turned far enough use a sharp chisel to break the tack welds and the job is complete.

*Marquette Mfg. Co., Minneapolis, Minn.

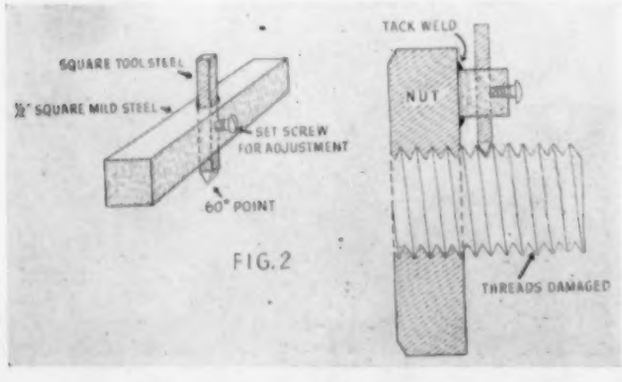
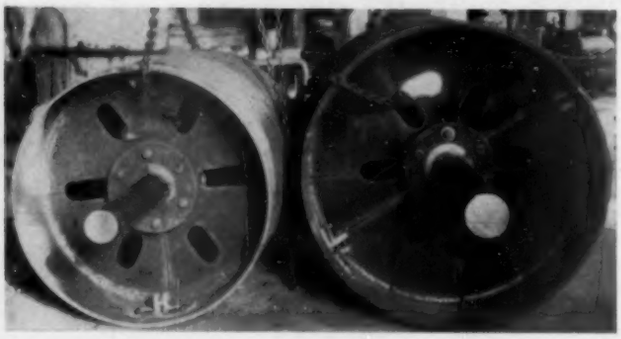


FIG. 2

How a scrap piece of tool bit can be used to repair damaged thread.



Two welded pulleys made for rock belt conveyor system. Web plates split radially (flame cut) to prevent distortion in welding.

Two Rock Belt Pulleys Fabricated by Welding

By CHESTER L. WRIGHT

★ As shown in the photograph, we recently fabricated two fairly large pulleys for our rock belt conveyor system at the Dewey Portland Cement Co., Dewey, Okla. The first step was forming the cylindrical face from ¼ in. boiler plate, the respective pulley diameters being 36 in. and 42 in. The length of each pulley was the same, 45 in. Next, two web plates were cut for each pulley and then the hubs were welded to these plates. As shown in the illustration, hand-holes were cut in the web plates and then the webs were split radially with an oxy-acetylene torch from the outer edge of the web to the hand-holes. This was done to prevent distortion in welding.

After the welding was completed, the web plates were cut in half to form a split pulley. The cylinders, of course, were formed in half sections. We found the welded pulleys practically unbreakable and while we do not have definite figures, we believe that we saved money on this job.

» «

Welded "Cage" Protects Isolated Power Plant

★ Power plants driving isolated oil well pumps are exposed to the meddling of inquisitive children, and also to the depredations of bands of thieves who range the oil fields, stripping unguarded units and selling their loot in far distant cities. One oil producer called on the welder to provide an enclosure for the pump-drive engine which would afford security, yet leave the engine

Welded throughout, even to the bolts attaching the roof timbers to the frame, this engine housing defies pilferers and protects property.

open to air cooling and to inspection from a distance.

The "cage" was built up of 2-in. pipe standards, set in concrete, and having a top rail of the same material, all oxy-acetylene welded together to form a unit. On three sides bits of sucker rod no longer suitable for pumping service were welded on 6-in. centers, with the fourth side consisting of a frame of the same material, latticed with smaller bars, all being swung on hinges at one corner post, and equipped with a strong hasp and padlock at the other.

Even the vee-belt drive is protected by this unique cage, one of the side bars being carried across the opening left for the belts so that the drive cannot be dismantled (or a belt replaced) without the rod being cut. After such a replacement, the welder either replaces the sucker rod cut out to permit the work, or tacks the previous one in place.

» «

Welded School Building Erected in Two Weeks

★ Public School No. 213, located at Hegeman Ave., Brooklyn, N. Y., is the latest addition to the growing list of arc welded buildings in the metropolitan area of New York City. This is a four-story building, 182 ft. 7 in. long. The width is variable, since it has an east wing 89 ft. 11 in. by 60 ft., and a west wing 61 ft. 5 in. by 60 ft. The building was erected and welded within two weeks after placing the first column.

Current control was facilitated by installing all five of the welding machines at one corner of the building, where they remained until the welding was completed. Welding operators were able to signal the engineer in charge of the machines for any necessary

Five arc welders at corner of building to facilitate current control by one supervisor. Photo (Wilson Welder & Metals Co., Inc.).

adjustments. Close grouping of the machines permitted one man to take care of all of them without loss of time. Approximately 420 tons of steel were used in the construction. Five 300-amp. Wilson welding generators, powered by Buda engines, were used, and all welding was done with Airco No. 87 electrodes.

» «

Welded Steel Barges Have Greater Carrying Capacity

★ Ten ash removal barges made entirely of arc-welded steel were recently built for the Department of Sanitation of the City of New York. The barges were built at Mariner's Harbor, Staten Island, by the Brewer Dry Dock Co., general contractors. Each welded steel barge will replace two wooden scows formerly used for disposal of ashes and rubbish, thereby saving a substantial sum in rental and towing.

These barges are of the all-welded steel hopper type, 150 ft. in length, 37 ft. in width and 12 ft. 9 in. in depth to the deck. For additional capacity the barges are fitted with a coaming 5 ft. high.

Work on these 10 barges was completed three days ahead of schedule. The layout of the work provided for building of sections of the double bottom, sections of the wings or double sides, and sections of the rake ends, all of which work was carefully done in jigs. This resulted in greater speed and a higher grade of fabrication. The illustration shows the eight barges in the water and two on the building ways, ready to be launched.

These scows are substantially built of heavy shell plating, well framed with angles. The hopper plating is especially heavy to withstand the wear and tear of the buckets used in unloading. No buckets are used in loading. Loading platforms are so arranged that trucks containing ashes and rubbish are backed on to the platform directly over the barge, and then dumped.

The total thickness of metal through the head logs and corners, considering the fender bars which are super-imposed on the plating, amounts to 1½ in. Hence these barges will take a substantial amount of abuse. Bilges and corner rakes are well rounded, making for easy towing. Hobart arc welders, of 300 amp. capacity, were used in building these 10 welded barges.

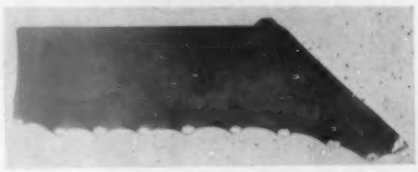
Ten welded ash disposal barges replaced 20 wooden scows. Photo (Hobart Bros. Co.).

» «

A Convincing Demonstration Of Value of Hard-Facing

★ There are "tricks of the trade" in every business, but few are as convincing as the example illustrated here. This plowshare was originally brought into a Missouri welding shop for an ordinary resharpening. Resolving to prove to its farmer-owner that hard-faced shares are more wear-resistant than ordinary steel shares, the shop operator applied a few drops of hard-facing alloy at 10 different spots along the share edge and nose. The share was then drawn and resharpened as usual. When it was returned to the farmer, no mention was made of the hard-facing or of the fact that the protected spots would cause uneven wear.

Unsuspecting, the farmer plowed 15 acres of sandy soil with it. But when he noticed the unusual, irregular edge, he was both baffled and curious. What had been done was explained to him when he inquired at the shop, and it wasn't long before he brought more implements to the shop.



How hard-facing resists abrasion on a plowshare. Photo (Haynes Stellite Co.).

» «

Welded Whirligig for World's Fair Fun Seekers

★ One of the thrills for World's Fair visitors at New York this year is a new aerial ride built by Spillman Engineering Co., of North Tonawanda, N. Y. It is of all-welded construction except the field assembly joints, which are bolted, and a few rivets used in the pre-assembly of portions of the bracing. The ring on which planes are mounted is all welded, except where sections are bolted together for shipping. The central tower, which is 80 ft. high, is also built sectionally. Altogether, the structure required 750 lbs. of 3/16 in. and ¼ in. electrodes.

Fig. 1—Aerial ride being made ready for a preliminary test. Photo (Air Reduction Sales Co.).

Fig. 2—Welding the supporting base. Photo (Air Reduction Sales Co.).

New Product Developments

P&H-Hansen Model WA-200 Square Framed Arc Welder

★ The Harnischfeger Corp. of Milwaukee, Wis., announces the new P&H-Hansen Model WA-200 square-frame welder for multi-arc service. Featured by its simplicity, compactness, and ease in operation, it is said to be precision built. The WA-200 requires less than 3½ sq. ft. of floor space, and offers a welding range from 40 to 225 amps. Advantages pointed out include automatic volt-ampere regulation, self excitation and internal stabilization of welding current. Model WA-200 has but two major parts—the one-piece frame and the rotating member. There are no external exciters, reactors, resistors, rheostats or separate stabilizers.

P&H-Hansen Model WA-200 arc welder.

Spring-mounted louvres can be snapped on and off to make periodic inspection of brushes and commutator or for minor adjustments. Top and plates are also easily removed. With the new type of patented frame promoting extremely rigid construction and designed to protect bearings against misalignment and wear, vibration is said to be absent. The rotating member is statically and dynamically balanced. The new unit will fit on a shelf or under a bench—out of the way.

Where a wider welding range is desired, these units may be hooked in parallel without special adjustments to gain any desired welding amperage. For further information regarding Model WA-200, address the Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

» «

New Line of Stainless Electrodes

★ A complete line of stainless steel electrodes covering all chemical analyses—claimed by the manufacturer to be an advancement in uniform, high-quality weld deposits—is offered by The McKay Co.

These electrodes are known as McKay Certified Stainless Electrodes. Each package contains a certification of weld deposit analysis rather than the wire analysis, which has been the practice in the past. Further claims for superiority are: (1) Instant contact upon restriking arc. (2) Maximum ease of slag removal. (3) Spatter free within practical limits. (4) Exceptionally smooth bead with perfect weld contour. (5) All alloys contained in core wire.

A 16-page booklet describing the certification process of weld deposit analysis and the welding procedure for the various stainless steels may be obtained by writing to the sales office of The McKay Co. at York, Pa.

» «

Welding Jigs For Shafting, Pipe, or Tubing

★ Shown in Figs. 1 to 3 are simple jigs and clamps designed for quickly and accurately aligning and clamping any two pieces of shafting, pipe or tubing which are to be welded together. The Nelsonville Foundry and Machine Co. of Nelsonville, Ohio, is manufacturer. The jig consists of a semi-steel beam 6 ft. long accurately machined with a groove in the center, four tongued vee block clamps which may be set any place along the beam.

The proper aligning of a shaft consists simply of laying each end of the shaft in two of the vee blocks. Clamping is done by sliding each of the vee block clamps to a point between the two bottom vee blocks and tightening down on screw on each clamp.

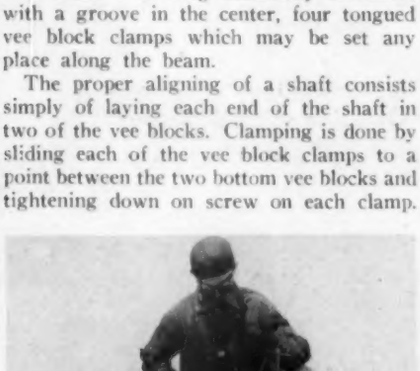


Fig. 1—Welding jig simplifies the job of butt welding steel shafting.

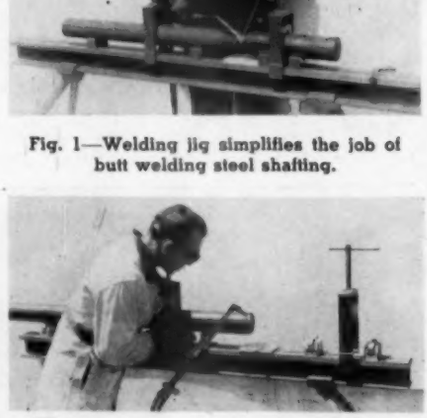


Fig. 2—Flame-cutting and scarfing are easily handled on this jig.

Fig. 3—Welding of large diameter pipe is greatly expedited in the jig.

Anyone can perform these simple operations in 30 sec. it is stated.

During welding the clamps can be loosened, the shaft rotated and the clamps retightened in a few seconds, with one hand, without taking the torch off the weld. This keeps the weld hot and prevents heat loss, speeds up actual welding time and gives the welder a chance to turn the work frequently. The beam is standard on all jigs shown herewith. Rollers and other attachments may be purchased separately.

Cutting and scarfing of pipe and tubing may both be done in the same operation if desired. By use of the torch holder attachment and the hand-operated geared drive unit (Fig. 2) a smooth, even bevel is obtained.

For welding, the two scarfed ends are butted together, each firmly held and aligned by two rollers and one roller clamp. A continuous weld can then be made completely around the pipe in one operation, either by using the 4 free turning rollers and rotating the pipe by hand, or by using 3 free turning rollers and the geared drive roller unit, either hand operated or motor driven. The motor drive is operated by a foot switch and speed is controlled by a rheostat.

Figure 3 shows the adaptation of the welding jig to large diameter pipe. Welding of large pipe may be done by using 4 free-turning rollers, or with 3 free-turning rollers and one geared drive, motor driven. Rollers for large pipe are larger than used on the tube welding jig. They may be purchased separately to fit other jigs or a complete jig for large pipe may be purchased as a unit.

Of greatest convenience and usefulness in testing centerless shafts, for straightness, are two free turning rollers. Simply lay the shaft in the rollers and rotate by hand and if the shaft is the least bit crooked it is immediately apparent. Straightening may be done by using two vee blocks and one vee block clamp.

» «

New Rego KX Torches

★ The new Rego KX cutting torch is said to meet the demand for a torch that will bring speed and economy to tough cutting operations such as hole punching, cutting rusty multiple plates, deseaming billets, cutting heavy sections, etc. Features of the Rego KX torch are:

(1) Stainless steel head withstands terrific heat without distorting.

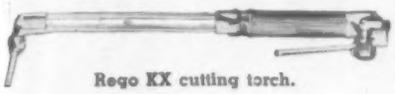
(2) Stainless steel tubes in triangular construction with welded spacer gixe maximum strength and added rigidity.

(3) High-pressure valve is accurately constructed. Diaphragm in valve eliminates customary packing—assures leakproof operation. Long handle provides maximum leverage—gives sensitive control.

(4) Forged brass body incorporates shut-off valves that have large easy-grip wheel handles with pressure-fitted monel stems.

(5) Solid-drawn copper tips give ideal gas mixture with faster preheat to operate under toughest conditions.

To meet individual operator preferences the following models are offered: (a) A 19 in. or 26 in. length; (b) A 75 deg. or 90 deg. head angle; (c) Two positions of high-pressure valve levers, bottom and side; (d) Three complete series of tips, each with correct varying amount of preheat hole area.



Rego KX cutting torch.

To meet the need for a rugged cutting torch with a low price, Rego engineers evolved the KXX model. Except for materials used in head and tubes, the Rego KXX is identical in construction to Rego KX. A hard, non-warping, heat-resisting bronze is used in the KXX head and special alloy tubes supplant stainless steel. This substitution in materials reduces manufacturing costs, yet provides the user with a good quality torch.

The Bastian-Blessing Co., 242 E. Ontario St., Chicago, will be glad to send a copy of the KX folder, which describes in detail features of performance and economy as found in these new cutting tools.

» «

Flame Descaling Apparatus

★ Illustrated is the new oxy-acetylene descaling apparatus recently developed by Air Reduction Sales Co., 60 East 42nd St., New York City, to remove scale and other similar accumulations from iron and steel. This is accomplished by rapidly heating such deposits with the multi-flame tips, and causing the cracking-off of the scale as a result of the differential expansion between scale and base metal. This process removes scale from ingots, billets and slabs to expose seams and defects for inspection prior to scarfing or chipping, also from forgings and steel castings prior to machining and from steel castings after annealing. Where necessary, apparatus is mounted on wheeled carriages for easy travel across steel surfaces.

A secondary, but equally important function of the apparatus, is the process of driving out the occluded moisture from within and beneath the surface scale of structural steel and plate. This is done by rapidly heating the surface with the high-temperature flames, leaving a warmed surface for painting. Immediately after the flame application, the surface is wire-brushed and swept clean of loosened scale particles and dust. Painting follows before recondensation of moisture on the surface. An ideal paint base is thus provided and danger of further loosening of protective mill-scale, through weathering, is minimized.

Airco oxy-acetylene descaling apparatus.

» «

Welders' Chipping Hammer

★ "The Chicago Manufacturing & Distributing Co., 1928 W. 46th St., Chicago, Ill., maker of an extensive line of chipping hammers and chisels, has recently developed a welder's chipping hammer. This tool is intended for chipping off slag from the weld, and for general purposes. Welders should find it very handy for this purpose.

Welder's chipping hammer.

It is not necessary for a welder to set aside his rod holder in order to chip with a cold chisel and hammer. One hand is always free for the manipulation of the chipping hammer. The combination drift and chisel feature should be found ideal for chipping in close quarters.

Approximate weight of hammer is 14 oz. Overall length of hammer is 11 in. Overall length of head is 5 in. drawn out to a chisel and drift point. Made of high-grade tool steel, heat treated to withstand severe service.

» «

Carbon Welding Electrodes

★ The new Becker Bros. Carbon Co. BBB welding electrodes, are claimed to offer better economy since they are considerably slower burning. Arc control is said to be improved with less "wandering" and, since heat is intensified at the point of weld, there is less spread of heat to adjacent areas. The makers also claim that the new BBB electrodes stand up better at high current densities, give increased penetration, and reduce electrode heat at and above the grip by confining it more closely to the welding point.

A newly published bulletin gives prices and descriptions of the new BBB welding electrodes. In addition to general operation data concerning grip, length of taper, position of shield, etc., the bulletin illustrates practical solutions to various welding problems.

BBB cored electrodes for a-c welding and cutting are also explained and priced. These bulletins are offered to anyone interested. Write to Becker Bros. Carbon Co., 3450 S. 52nd Ave., Cicero, Ill.

New Type Ventilated Eyeshield

★ A new design of eye protection device is being offered, consisting of a light, adjustable, transparent shield, that will not ignite spontaneously and is said to offer effective protection from hot sparks, dust and flying particles. The visor (available in clear, smoked, amber, light green or dark green material) is attached to a comfortable headgear. It is amply ventilated.

Jackson eyeshield has a light weight transparent visor.

The transparent visor has a metal binding to secure stiffness. A spark deflector guards the space between visor and forehead, without cutting off ventilation, and a fireproof duck skull cap extends halfway back over the head, protecting head and hair. The shield, designated as Model CH-5C, is manufactured by Jackson Electrode Holder Co., Detroit, Mich.

» «

Rotary Files Ground from Solid

★ The Grobet File Corp. of America, 3 Park Place, New York City, has recently added to its regular lines of hand cut rotary files and milled cut rotary files, a complete line of rotary files ground from solid blanks after

Grobet rotary file.

hardening. Made of super high-speed steel. They may be resharpened at a very low cost. Illustrated and described in Catalog G99.

» «

Stainless Steel Welding Electrode

★ The Lincoln Electric Co., Cleveland, Ohio, announces a new arc welding electrode of the stainless 18-8 type, having 3½% molybdenum. The new electrode, designated "Stainweld C," was developed by Lincoln engineers to meet a demand for an electrode to weld the stainless steels which contain approximately 3½% molybdenum.

A coating is provided which prevents oxidation of weld metal and keeps the analysis of deposited metal virtually the same as the parent metal. Welds are of high tensile strength and ductility and possess corrosion resistance qualities equal to the parent metal.

The electrode is made in three sizes—⅛, 5/32 and 3/16 in. diameters and 11½ in. lengths, in 25 lb. packages.

News of the Industry

BALTIMORE TO GET NEW WELDING CODE—The City of Baltimore, Md., under the direction of JOHN M. RUSSELL, building construction engineer and secretary of the Building Code Committee, has just completed a proposed draft of regulations for welding which will be presented to the mayor and city council in November, 1939, for approval. If approved this will place structural welding on a par with other methods of construction. "Tentative Rules for Qualification of Welding Processes and Testing Operators" as formulated by A.W.S. were adopted by the city for qualifying welders.

Welding knowledge and experience of various groups were drawn upon through the participation of these men: VAN RANSSELAER P. SAXE, consulting structural engineer; H. N. BOETCHER, Consolidated Gas and Electric Co.; BASIL OSMIN, welding engineer, Maryland Casualty Co.; J. H. DAVIS, American Iron and Steel Institute; J. C. HARRIS, JR., Consolidated Gas and Electric Co.; J. A. BROWN, Member of Building Code Sub-Committee; and C. W. PATTERSON—Member of Building Code Sub-Committee.

The proposed welding code deals broadly with electric arc, gas, and resistance welding and flame cutting. Following ten paragraphs are included: 1—General Requirements for Welding and Cutting; 2—Definitions for Welds; 3—Butt Welds; 4—Fillet Welds; 5—Welded Girders; 6—Welded Columns; 7—Stresses Induced by Welded Connections; 8—Qualification of Contractors and Operators for Fusion Welding; 9—Supervision and Inspection of Fusion Welding; and 19—Resistance Welding.

Personals

FREDERICK T. LLEWELLYN retired as research engineer of United States Steel Corp. of Delaware on June 1, 1939, his 70th birthday, after 49 years of service with that company. Born in Wales in 1869, he came to this country in 1890 and started work with one of the predecessors of the American Bridge Co. He erected the first steel frame building in New Orleans, and spent several years in Mexico.

A past president of The American Welding Society, he has been very active in its affairs. At the time of his retirement he was a member of the Board of Directors, The Executive Committee of the Welding Research Committee, and the Editorial Committee of the A.W.S. Welding Handbook. He has taken an important part in the development of structural welding and in the use of welded rolled steel for machinery construction. He is the author of the section, "Economics of Welding" which appears as the preface in the A.W.S. Welding Handbook, 1938 edition.

Upon the eve of his retirement from business, the board of directors of American Institute of Steel Construction presented Fred T. Llewellyn, research engineer of the United States Steel Corp. of Delaware, an engrossed resolution of appreciation for his contribution to the structural steel fabricating industry. "Mr. Llewellyn has served as a member of the Institute's Technical Advisory Board and as Chairman of its Committee on Manual and on Specifications and is to a great extent responsible for the successful carrying out of the work of these committees," says the Institute's resolution.

FREDERICK T. LLEWELLYN

» «

J. FREDERIC WIESE, who since 1935 has been assistant to vice president of Lukens Steel Co., Coatesville, Pa., has been appointed general manager of sales. Mr. Wiese was born in Parkesburg, Pa., in January, 1899, receiving his education in the Parkesburg schools and Swarthmore College, from which he was graduated in 1921.

In August, 1926, Mr. Wiese joined the Lukens Steel Co. and has served in its flanging, railroad and general sales departments. In 1935, Mr. Wiese was appointed assistant to vice president in charge of sales, in which capacity he served until his recent promotion.

J. FREDERIC WIESE

» «

MARVIN W. SMITH, manager of engineering of Westinghouse Electric & Mfg. Co., has been elected a vice-president. Mr. Smith, who will direct all the company's engineering activities, has been associated with Westinghouse since he left college in 1915. Mr. Smith began as a student engineer, did shop and office work, then moved steadily upward. He has been Manager of Engineering since May 7, 1936.

MARVIN W. SMITH

In 1938 Mr. Smith received the Westinghouse Order of Merit award, a medal and citation which, since its inception in 1935, has been conferred on only 85 Westinghouse employes. In conferring the award, the Board cited Mr. Smith "for his rare intellectual honesty at all times; for unusually open-minded approach to difficult problems requiring solution; and for capable and aggressive leadership of the Central Engineering and Research Departments."

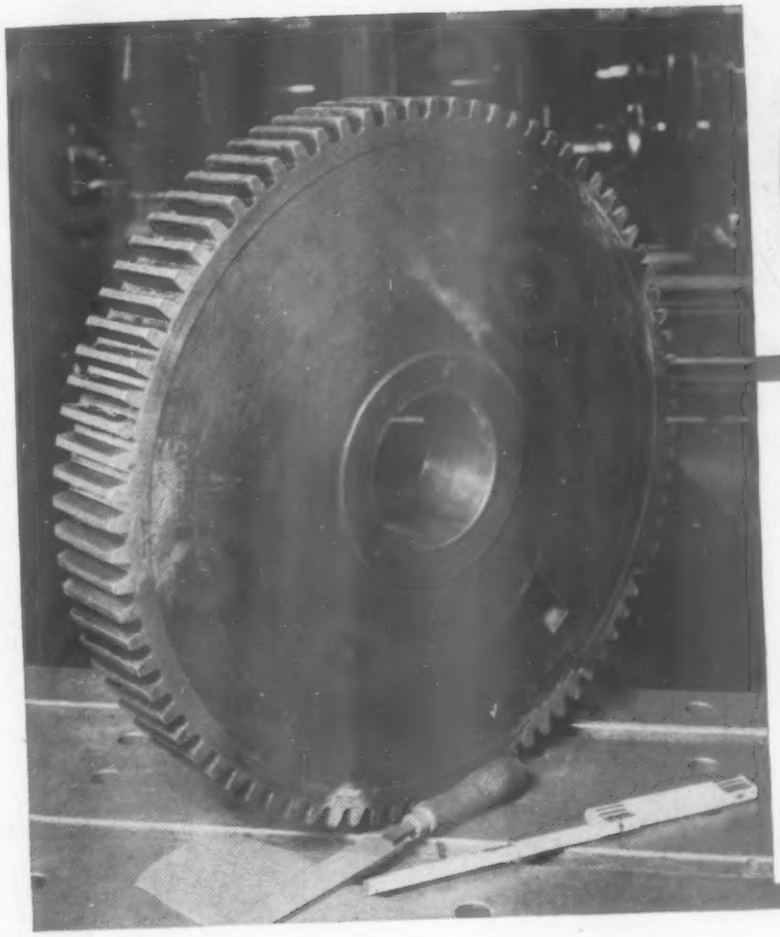
» «

L. E. NICHOLS has been appointed technical advisor and sales engineer for the Detroit

Electric power control unit in welding laboratory of Linde Air Products Co., Niagara Falls, N. Y. Provides both a-c. and d-c. for Unionmelt process. Photo (Westinghouse).

ANACONDA 997

a tough weld metal with low fuming characteristics



This steel gear broke down six different times over a period of three years. All repair welds were made with Anaconda 997 Low Fuming Rods, and *each succeeding fracture occurred outside of any previously welded area*—interesting evidence of the dependability of welds made with this tough Anaconda Rod.

IN the general oxy-acetylene repair welding of equipment made of copper alloys, nickel alloys, steel, cast iron and malleable cast iron, Anaconda 997 Low Fuming Welding Rods provide tough, high strength welds. When correctly used, they give off a minimum of fumes. This rod is manufactured under U. S. patents RE-17631 and 1525058.

Sixteen other Anaconda Copper Alloy Welding Rods are available for general and specific welding purposes. They can be obtained from welding supply houses everywhere.

Anaconda Publication B-13, a twenty-eight page descriptive and informative manual covering the whole list of Anaconda welding rods, should be in your files. Write for a copy, today.

Visit The Copper & Brass Industry Exhibit in the Metals Building, New York World's Fair—1939.

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ANACONDA

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Company

district of National Electric Welding Machines Co. The Detroit office of this company is now located in Room 6-255 General Motors Bldg.

» «

C. H. KUTHE has recently been appointed technical advisor for the Michigan Division of Revere Copper and Brass Inc. His headquarters will be located at the Detroit plant, 5851 West Jefferson Ave.

» «

VINCENT H. GODFREY recently joined the general sales staff of the Page Steel and Wire Division of American Chain & Cable Co., Inc., Monessen, Pa. Mr. Godfrey is a graduate of the United States Naval Academy, Annapolis, 1915, and is a Lieutenant-Commander of the United States Navy (retired). He will specialize in the sale of Page welding electrodes and gas welding wires.

Trade News

MANUFACTURERS & FABRICATORS INC. have removed their offices and plant to larger quarters at Elyria, Ohio. This company specializes in fabrication of steel by welding, and has recently gone into the manufacture of laundry equipment.

» «

WESTINGHOUSE APPOINTS 1939 RESEARCH FELLOWSHIPS—Appointment of the second group of five Westinghouse Research Fellows has been announced by the Westinghouse Electric & Mfg. Co. The first group of five was appointed last year, and all of the group have been reappointed for a second year of fundamental research work.

These Fellows are named under a plan announced by Westinghouse in the fall of 1937, according to which ten young research men will be supported for fundamental research in fields broadly related to the electrical industry. They work on basic problems not directly connected with the immediate needs of the industrial research program of the company.

These research fellowships will be carried on under the general supervision of DR. E. U. CONDON, associate director of Westinghouse Research Laboratories. The new appointees are: DR. WILLIAM A. JOHNSON, of Pittsburgh, Pa.; DR. ALOIS LANGER, of Minneapolis, Minn.; DR. THOMAS ALBERT READ, of New York City; DR. ALDEN H. RYAN, of Ames, Iowa; DR. G. L. TAWNEY, of Cambridge, Mass.

» «

THE LINCOLN ELECTRIC CO. has opened a new office in Duluth, Minn., at 222 South 21st Ave., East. A stock of electric welders, electrodes and supplies will be maintained. I. R. BARTTER, formerly with the Minneapolis office of the company, will be in charge of the new branch.

» «

THE HARNISCHFEGER CORP. of Milwaukee, Wis., has appointed the STRAHLE-JOHNSON SUPPLY CO., 1300 Broad St., Chattanooga, Tenn., as an agent for sale of P&H-Hansen welders and Smootharc welding electrodes on an open basis. This distributor will operate under supervision of Mr. Craig of the Harnischfeger, Memphis office.

» «

GOOD LUCK PENNIES—A. H. Friese, president of The Welding Engineering Co., 264 E. Ogden Avenue, Milwaukee, Wis., is making a free offer of "Good Luck Pennies" to men who are interested in welding. Anyone interested in receiving one of these free "Good Luck Pennies" should write to Mr. Friese at the above address.

» «

COMMERCIAL ACETYLENE SUPPLY CO., INC., has moved its New York office from 40 Rector St. to 60 E. 42nd St., New York City. This change was made effective May 31.

» «

RAISE WESTINGHOUSE SALARIED EMPLOYES—In view of improved business, full restoration of pay reductions for 8700 salaried employes of Westinghouse Electric and Mfg. Co. was made June 1. Salaried employes affected have been receiving 90% of their base rates since June 1, 1938. The Westinghouse wage and salary plan, from which all employes receive extra monthly pay, based on average profits of three months preceding, will continue to function. Under this plan, employes have received extra pay each month, except one, for the past three years.

» «

HOBART BROS. SALES & SERVICE has moved to new and larger quarters at 1036 West Lake St., Chicago, Ill. H. K. MILLER is the Chicago sales manager. A complete stock of welding equipment and electrodes is carried. The former address of Hobart's Chicago office was 7712 Jeffery Ave.

Construction

SHELL PETROLEUM CORP. plans construction of a 35-mile, 6-in. welded pipeline from the Bennett and Denver oil fields of Yoakum County, Texas, to its trunk line at Hobbs, N. Mex.

» «

ATLANTIC REFINING CO. has plans for construction of a pipeline in connection with a new natural gas recycling plant in the gas field district of Deslaco, Hidalgo County, Texas. Project will cost about $500,000.

» «

THE MOTOR FUELS CORP., of Fort Worth, Texas, is building a new refinery at Levelland, Texas. A 35-mile welded pipeline will serve the plant. Total cost of combined project will aggregate $285,000.

Repair Shops

DIRECT MAIL ADVERTISING GETS RESULTS Confronted with the problem of creating new welding business in competition with established firms, Al Cassidy, of Hempstead, N. Y., solved it successfully with the help of Uncle Sam's postal system. In four years he has built up a satisfactory volume of business, and numbers among his steady customers some of the largest and best known firms on Long Island. His first mailing list came from the classified pages of the telephone directory. But today he has in his files the names and addresses, all systematically classified, of over 3,000 live prospects. These are followed up monthly by direct mail advertising.

He uses individual cards monthly for each field which he has found most productive of results. Each card is illustrated with a line drawing, most of the copy being prepared by Mr. Cassidy and is directed to meet the needs of a specific field. Long Island is an important flower and plant growing center for the New York City market, and contains approximately 12,000,000 sq. ft. of greenhouse glass. In all of these hundreds of plants, there are one or more boilers, and

Structural welding on 13-story Women's Hospital of Pittsburgh. About 1000 tons of steel were arc welded in 58 working days. Photo (Westinghouse Electric & Mfg. Co.).

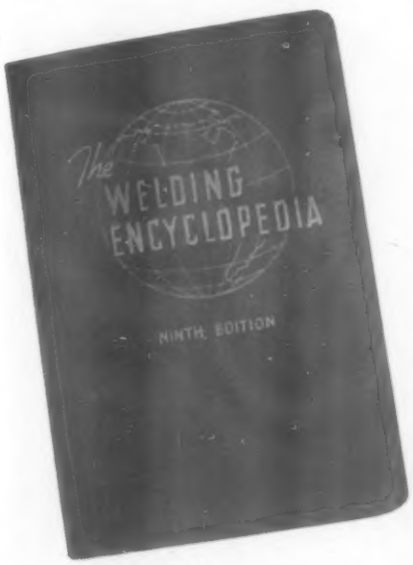
HERE IS YOUR ANSWER TO EVERY WELDING PROBLEM

—the NINTH EDITION

The WELDING ENCYCLOPEDIA

A concise volume containing complete, fundamental reference information on all methods of welding—electric arc, oxy-acetylene, resistance and Thermit. On the job, on your desk, in the drafting room or in the plant, this new book gives you instantly the welding information you need to know.

A new edition, entirely rewritten from cover to cover, with latest data on new developments, experiment and research. All carefully sifted, boiled down and concisely presented. Here are centuries of welding experience ready for your use. It is not from one single source, for the entire welding industry has furnished the data.



696 Pages—Over 800 Illustrations
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Alphabetically arranged for instant reference. The Welding Encyclopedia gives you complete information on thousands of subjects.

Typical Questions Discussed in this Book

In welding aluminum and its alloys what flame adjustment is recommended? How would you estimate costs and materials? In arc welding, what electrode manipulation should be used?

Annealing—What can annealing do for a weldment? Is the metal structure improved? What are recommended practices?

Boiler Welding—What are the provisions of A. S. M. E. Boiler Construction Code? What are limits of pressure and temperature under Paragraph U-69?

What is the temperature of the oxy-acetylene flame? The electric arc? Thermit reaction?

What metals, welding methods and procedures are used in aircraft welding?

What method of welding has greatly simplified the welding of copper?

Does the oxy-acetylene cutting flame have any effect on cut edges of steel?

What are the common "Designs" of welds? Where and how are they used to best advantage?

What properties and characteristics would you look for in selecting electrodes for resistance welding?

How would you go about redesigning machinery for welding? Can a combination of steel castings and rolled steel be used to advantage?

Can malleable iron be welded? What are characteristics of this metal? How can you identify it?

Where is manganese steel used most widely? What should be known about this metal before starting to weld?

What are the melting points of various metals?

What should the welder know about the structure of metals? of the composition of metal and non-metallic elements? about the Iron Carbon Diagram? See "Metallography."

What are the possibilities of Metal Spraying? Where can it be used effectively and what metals are adaptable to such application? What results may be expected? See "Metal Spraying."

In welding stainless clad steels, what procedure would you follow? Which side should be welded first?

How does a molten puddle of steel react under the three adjustments of the oxy-acetylene flame, i.e. neutral, oxidizing and carbonizing? What flame adjustments are recommended for the different metals?

Preheating—Can you name the three important reasons for its use? How does shape of piece govern point where preheating is applied?

How many codes are in existence which govern welding? To what specific types of welded fabrication do they apply? Name requirements of each?

What is indicated by results of reduced-section tension test? free-bend test? root-break test? side-break test? nick-break test? How is each made?

Where can silver solders be used to advantage? What metals are particularly adaptable to this process? Is joint design important?

What are content and designation of the most frequently welded metals? See "Specifications for Materials."

In welding Stainless Steels, what properties of the two general classes of these metals must be kept in mind?

In designing welded Structural Joints, what unit stresses (shear, tension and compression) are permitted under A.W.S. Building Code.

What kinds of metal and what shapes are best adapted to Flame Hardening? What advantages has it over furnace hardening?

What are the various forms of welded joints? What are root, leg, toe, face and throat of a weld?

Name qualification tests required for welding large steel tanks? What is the most economical design for open rectangular tanks?

What is the reaction in Thermit welding? Where is the process especially useful and what preparation is necessary?

What shop exercises are essential in a training course for oxy-acetylene welders? for arc welders? What shop equipment is necessary? See "Training Operators."

Welding Rods and Electrodes —Specifications for various A.W.S grades are given as well as tensile requirements of all-weld metal coupons.

How are Welding Symbols used and how do they simplify detail drawings and shop blue prints?

What is "Arcronegraph," "Avialite," "Blackor," "Borium," "Calobar," "Manganal," "Polygraph"? Who makes it? All leading trade names with manufacturer's name and address are given.

THE WELDING ENGINEER PUBLISHING CO.
508 So. Wabash Ave., Chicago, Ill.

Please enter my order for (1) a copy of The Welding Encyclopedia at $5.00 and (2) The Welding Engineer for 1 year at $3.00, total $8.00. My check ( ), money order ( ) is enclosed for **$6.50 in full payment for both. I save $1.50.**

Name_____

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I'M SAVING $1.50 ON THIS ORDER

MAIL THE COUPON TODAY

Engineers, Superintendents, Foremen, Supervisors, Instructors and Welders— NO MATTER WHAT KIND OF WELDING YOU DO, YOU NEED THIS BOOK!

considered as a whole, these firms spend a tidy sum each year for boiler retubing and repairing.

When Mr. Cassidy started his business about 4½ yrs. ago, he was comparatively unknown. But direct mail advertising to the florists has made his firm well known. Today his firm handles a substantial amount of boiler retubing and repairing work for Long Island greenhouses.

And that, of course, is only one of many industrial and commercial fields that spend large sums every year for this sort of work. Other fields included in Cassidy's mailing list are hotels and apartments, schools and colleges, department stores and office buildings, laundries, factories, plumbing and heating contractors, etc. Recently he added to his mailing list the names of all cleaning and pressing establishments in his territory, and made up a special postal card for them. These cards advertised the retubing and repairing of pressing machine boilers. The response was immediate, and while most of the work done does not run into large figures this phase of his advertising campaign has paid for itself many times. In Mr. Cassidy's opinion the costs of direct mail are trivial in comparison with the results that can be achieved by a well conceived campaign.

Current Reviews

Lincoln Foundation Award Studies Now Available Book Form

Original studies of welding by 109 leaders in various branches of industry are contained in the new book, "Arc Welding in Design, Manufacture and Construction," just published by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. These studies comprise the outstanding papers of the recent $200,000 Award Program. They constitute a valuable source of scientific study, research and information on welding.

"Arc Welding in Design, Manufacture and Construction" provides scientific and technical schools, colleges and universities, engineering bodies and libraries, as well as industrial executives and officials, a huge volume of data on welding. The book should also be of value to designers, engineers, architects, production officials and others desirous of using arc welded construction.

With but few exceptions, papers are reproduced in complete form. Only those which were too lengthy for inclusion in their entirety are briefed. All essential photographs and drawings are included. Each study includes designs, calculations, procedures and other pertinent information relating the advantages of arc welded construction.

Contents of the book are arranged as chapters of 10 sections. Sections and chapters are as follows:

Section 1, Automotive—9 Chapters, 89 pages, 47 illustrations.

Section 2, Aircraft—6 Chapters, 74 pages, 38 illustrations.

Section 3, Railroad—11 Chapters, 130 pages, 60 illustrations.

Section 4, Watercraft—9 Chapters, 115 pages, 71 illustrations.

Section 5, Structural—14 Chapters, 248 pages, 113 illusrtations.

Section 6, Furniture and Fixtures—7 Chapters, 36 pages, 17 illustrations.

Section 7, Commercial Welding—Automotive Repair—Welderies—4 Chapters, 106 pages, 47 illustrations.

Section 8, Containers—11 Chapters, 156 pages, 64 illustrations.

Section 9, Machinery—29 Chapters, 382 pages, 190 illustrations.

Section 10, Jigs and Fixtures—9 Chapters, 65 pages, 48 illustrations.

The new book contains 1408 pages and a total of 695 numbered illustrations, including photographs and line drawings. Bound in convenient desk size, 6 in. x 9 in. with a simulated leather cover, the book is priced at $1.50 per copy, postpaid anywhere in the United States, $2.00 elsewhere. Copies may be secured by writing to *The Welding Engineer*, 506 So. Wabash Ave., Chicago, Ill.

Recent Patents

Hard-Facing Weld Rod

2,152,637. Anthony G. de Golyer, New York, N. Y. Filed Oct. 30, 1937. Issued Apr. 4, 1939. The weld metal compositions of this patent are intended primarily for deposition on surfaces or areas exposed to severe conditions of abrasive wear or impact or both. The inventor has found that certain ferrous alloys containing as essential components tungsten, molybdenum, chromium, and appreciable amounts of boron, are satisfactory for welding such surfaces. It is well to point out that it is difficult to forge or otherwise mechanically work this composition. Accordingly the boron is introduced during the welding operation. The rod may be in the form of a metallic unit having an adherent coating containing a boron alloy, or a chemical compound of boron which is readily soluble in the molten metal produced by the welding operation. The proportions of ingredients are 2 to 20% of tungsten, molybdenum, or chromium, 0.15 to 1.50% of boron, and the remainder substantially iron.

» «

Welding Hood Shield

2,154,774. William Otto Rienacker, Detroit, and Archie L. Perrigo, Armada, Mich. Filed May 19, 1937. Issued Apr. 18, 1939. The object of this patent is to provide a visor or shield whereby the operator may easily and quickly move to operative or inoperative position without the use of his hands, a light screening shield, so as to protect his eyes from the glare of the flash present during welding operations. Movement of the shield is obtained by means of a pneumatic tube through which the operator draws inwardly or blows outwardly. Toggle mechanisms are provided for locking the movable unit in the desired position.

» «

Arc Welding Flux

2,154,816. Archibald P. Johnston, Altadena, Calif., assigned to Standard Oil Co., Calif. Filed Oct. 19, 1936. Issued Apr. 18, 1939. A flux is described for use in arc welding. The flux comprises substantially equal parts of diaspore and titanium dioxide. Diaspore is known technically as aluminum monohydrate. Preferably the ingredients are in powdered form mixed with sodium silicate to form a paste. The paste may be applied to the surface of a welding rod, preferably being applied to a fabric covered rod.

» «

Portable Resistance Welder

2,155,412. Meril L. Eckman, Cleveland, Ohio, assigned to American Coach and Body Co., Cleveland, Ohio. Filed Feb. 1, 1937. Issued Apr. 25, 1939. A movable welder is described. The device has a pair of electrodes, one of which is mounted for movement toward and away from the other electrode. The movable electrode is provided with a lever which is actuated by a power-operated mechanism by means of remote control. Flexible conduits interconnect the power motor and the electrode tool. Suitable timing elements are provided to obtain automatic circuit control.

» «

Electric Pipe Welder

2,153,785. George D. Williams, San Francisco, Calif., assigned to Western Pipe & Steel Co., San Francisco, Calif. Filed Oct. 19, 1936. Issued Apr. 11, 1939. According to this invention relatively uniform circular weld seams may be produced between pipe sections having a diameter of from 6 to 10 ft. or more. Proper alignment of the walls is obtained irrespective of deviations of the individual sections from a true cylinder. The machine has elements for engaging two adjacent and aligned pipe sections, for rotating the sections about a horizontal axis. A welding head overlies the sections adjacent to the circular junction between them. The

Welded digester for a paper mill, designed for working pressure of 125 psi. Completely stress-relieved and x-rayed. Photo (Blaw-Knox Co.).

welding head serves automatically to supply a welding rod or wire to the junction. A backing bar is situated on the inner side of the pipe sections and slideably engages the region of the junction immediately below the welding rod or wire. A wheeled carriage, which can be moved longitudinally of the pipe sections, supports and moves the backing bar.

» «

Pressure-Controlled Current

2,155,413. Meril L. Eckman, Cleveland, Ohio, assigned to The American Coach & Body Co., Cleveland, Ohio. Filed Apr. 7, 1937. Issued Apr. 25, 1939. A portable unit is provided, in the operation of which the operator controls the flow of current by means of pressure exerted on the electrode. Changes in pressure required for actuating a current controller are varied by a suitable tension mechanism manipulated by the operator.

» «

Non-Austenitic Ferrous Welding

2,156,298. Franz Leitner, Kapfenberg, Steiermark, Austria, assigned to Gebr. Bohler & Co., Aktiengesellschaft Wien, Vienna, Germany. Filed Mar. 16, 1937. Issued May 2, 1939. When austenitic chromium steel alloys containing nickel or manganese or both, are used for welding non-austenitic ferrous metals, it is possible to obtain sound welds substantially free from blowholes and slag inclusions, only by protecting the welding rod in some manner during deposition of filler metal. This is usually done either by providing a protective coating on the outside of the rod or by enveloping the molten filler material with a protective gas. The patentee overcomes these difficulties by using a filler rod of the following composition—carbon not over 0.3%, 5 to 25% chromium, 3 to 27% nickel, 3 to 18% manganese, 0.3 to 6% molybdenum, and the remainder principally iron. This composition is claimed to produce a sound weld of excellent bonding characteristics between two or more contiguous members of non-austenitic ferrous metal. The rod can be used with oxy-acetylene or arc welding methods. In addition, the inventor suggests the use of one or more alloying elements such as vanadium, titanium, tantalum, zirconium, cobalt, or silicon in a total amount not exceeding 3% of the entire composition. Such alloying is useful where it is necessary to increase the temperature of fusion of the welding rod. It is also possible to replace the molybdenum content either wholly or in part, by tungsten.

» «

Welding in Successive Layers

2,156,299. Inventor and assignee same as in 2,156,298. Filed Mar. 19, 1937. Issued May 2, 1939. For welding in successive layers by electrical welding, or any type of fusion-deposition welding. Inventor suggests use of an austenitic steel welding rod containing carbon not exceeding 0.35%, 13 to 26% manganese, 3 to 15% chromium, the chromium content being approximately equal to one half the manganese content, and the remainder substantially iron. The rod is particularly suited for welding non-austenitic alloy steels.

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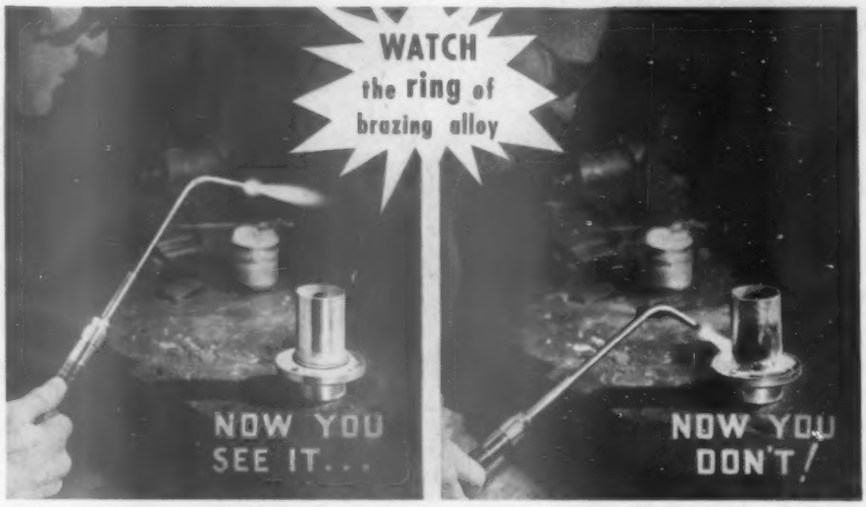

SIL-FOS

—flowing freely at 1300°F, makes joints between copper, brass and bronze that are stronger than the metals you join. It solves brazing problems for those who want better joints at low cost.

EASY-FLO

—has the lowest flow point—1175°F—of any brazing alloy making high strength joints. It joins either ferrous or non-ferrous metals and alloys. It is by far the most effective means of joining dissimilar metals and keeps costs low.

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Trade Literature

BONNEY FORGE & TOOL WORKS has just issued Catalog No. 39 covering a full line of alloy steel sockets, wrenches and small hand tools. The book contains 92 pages, is printed in two colors and attractively illustrated. A copy of this catalog may be had by writing to Bonney Forge & Tool Works, Allentown, Pa.

» «

THE SCULLY STEEL PRODUCTS CO., 1319 Wabansia Ave., Chicago, Ill., has recently published a new and improved stock list and reference book for 1939. This book is published mainly for greater convenience in ordering material from stock and contains a valuable reference section. A circular wire binding is used. This steel jobber is a subsidiary of United States Steel Corp.

» «

METAL SPRAYING—Metallizing Co. of America, Inc., has prepared a 26-page booklet giving complete details on metal spraying, with new pictures and applications, listing equipment necessary for such work. This company has also brought out a new Propane-Mogul gun. Use of propane gas in this new gun is claimed to reduce gas costs and increase speed of deposit.

The booklet and propane bulletin can be obtained from either of the following offices of the Metallizing Co. of America, Inc.—1351 E. 17th St., Los Angeles, Calif.; 562 W. Washington St., Chicago, Ill.

» «

THOR ELECTRIC TOOL CATALOG—The complete 1939 line of Thor portable electric tools is described in a 48-page catalog just issued by Independent Pneumatic Tool Co., 578 West Jackson Blvd., Chicago, Ill. The book, which is divided into four major sections, gives complete descriptions, specifications and prices on the entire Thor line of universal type electric drills, drill stands, screw drivers, nut setters, tappers, saws, hammers, grinders polishers, sanders, heat guns and electric tool accessories.

» «

"SHIELD-ARC JUNIOR" WELDER—The Lincoln Electric Co., Cleveland, Ohio, has published a four-page folder describing the new 150 amp. "Shield-Arc Junior" welder, which has a self-indicating dual-continuous control. Illustrations indicate clearly how the dual-continuous control feature helps the welder obtain the proper welding current and voltage he needs.

» «

AMCO GALVANIZING POWDER — This new product is described in a four-page folder issued by American Solder & Flux Co., Wayne Ave. and Berkley St., Philadelphia, Pa. This product can be easily applied to restore a permanent protective surface to metals that have been welded. Amco Galvanizing Powder can be applied either dry or in paste form and is then bonded to the base metal by means of an oxy-acetylene torch. It is claimed to possess corrosion resistance equal to that produced by the hot-dip process.

» «

EYE PROTECTION—The application of Lincoln "Super-Visibility" and "High-Visibility" welding lenses is described in a four-page folder issued by Lincoln Electric Co., Cleveland, Ohio. Considerable educational material on protection from ultra-violet and infra-red rays is included in the bulletin. Transmission curves are given for the No. 10 shade of welding lens.

» «

MIDGET MARVEL FLEXARC A-C. WELDER—Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa., has issued a four-page catalog section describing the Midget Marvel Flexarc a-c. welder rated at 30-140 amps. This model will handle from 1/16 to 5/32-in. electrodes and provides 12 steps of current adjustment. Will work on either 110 or 220 volt primary voltage.

» «

WELDING SERVICE SALES, INC., 954 Howard St., San Francisco, Calif., has issued a 56-page loose-leaf catalog covering its line of Weldco products. This jobber handles both arc welding and oxy-acetylene equipment. Welders' safety equipment and shop tools are included in the catalog.

» «

EYE PROTECTION BULLETIN—An 8-page bulletin on M.S.A. industrial eye protection has been published by Mine Safety Appliances

You Can Do a Better Job with

Build a lasting reputation for better jobs; insure tough, sound welds by use of Titan Doubly-Deoxidized Welding Rods. There is a specific Titan rod for every bronze welding operation.

PENN BRONZE—a general-purpose rod, melting at 1620° F. Tins readily and uniformly on galvanized, malleable or wrought iron, as well as steel, brass, bronze and any other non-leaded metal with melting point above 1850° F.

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Co. The front cover presents impressive statistics of the cost of eye injuries to industry, and features qualities of the various types of M.S.A. protective lenses. In succeeding pages are described a complete line of goggles and spectacles, welding helmets and shields, combination protective hats with welding shields or goggles and several new items. Copies of this Bulletin (No. CE-8) may be obtained free by writing to Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

» «

TONCAN IRON PIPE—Republic Steel Corp. has just issued a 44-page catalog, "Toncan Iron Pipe for Tough Service." This relates the story of Toncan copper-molybdenum iron pipe and covers: Electric weld process of manufacture; Rust and corrosion resistance; Recommended application; Details of various tests; Physical properties; Threading procedure; Welding; Sizes and weights; Outstanding installations and service records in specific fields; How to specify and order; Where to buy; and Other information. Those interested should address a request to Republic Steel Corp., Advertising Division, Cleveland, Ohio and ask for "Toncan Iron Pipe for Tough Service."

» «

FACTS ABOUT GRINDING WHEELS — The Norton Co., Worcester, Mass., has published a 76-page pocket size booklet which gives considerable valuable data on grinding wheels and grinding technique. Various types of grinding wheels are described and simple sketches help the reader to understand what takes place when grinding wheels are used in finishing operations. There are many technical data tables to help the reader select the proper wheel for any grinding job. The third section of the booklet contains in condensed form the reasons which should guide the purchaser of grinding wheels and also contains definitions of grinding terms in general use. A valuable booklet for the shop man.

» «

FABRICATION OF REPUBLIC "ENDURO" STAINLESS STEELS—Republic Steel Corp., Cleveland, Ohio, has issued a 42-page well illustrated bulletin on the fabrication of Republic Enduro stainless steels. The bulletin covers operations such as shearing, blanking, drawing, spinning, forming, rolling and pressing by means of a bending brake. Other operations covered in the bulletin include machine forging, soldering, silver brazing, and welding of stainless steels. Several pages are devoted to the subject of grinding, polishing and buffing, which are important operations wherever stainless steel equipment is fabricated.

Classified Section

ADVERTISING RATES

Help Wanted 75c per line, minimum 4 lines. Jobs Wanted 4 lines free. Other Ads $1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

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FOR SALE—One 500-amp. two operator Westinghouse electric drive arc welder, excellent condition. Attractive price. Also 200-amp. Lincoln. H. K. Miller, 1036 W. Lake St., Chicago, Ill.

BARGAINS—Demonstator Arc Welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Hobart Welder Exchange, Box U-691, Troy, Ohio.

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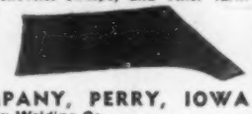
Canadian Patents 365,296 and 389,723



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